Central Sacramento County Groundwater Forum

GroundwaterDigest

September 2003

MWH

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Central Sacramento County Groundwater Forum

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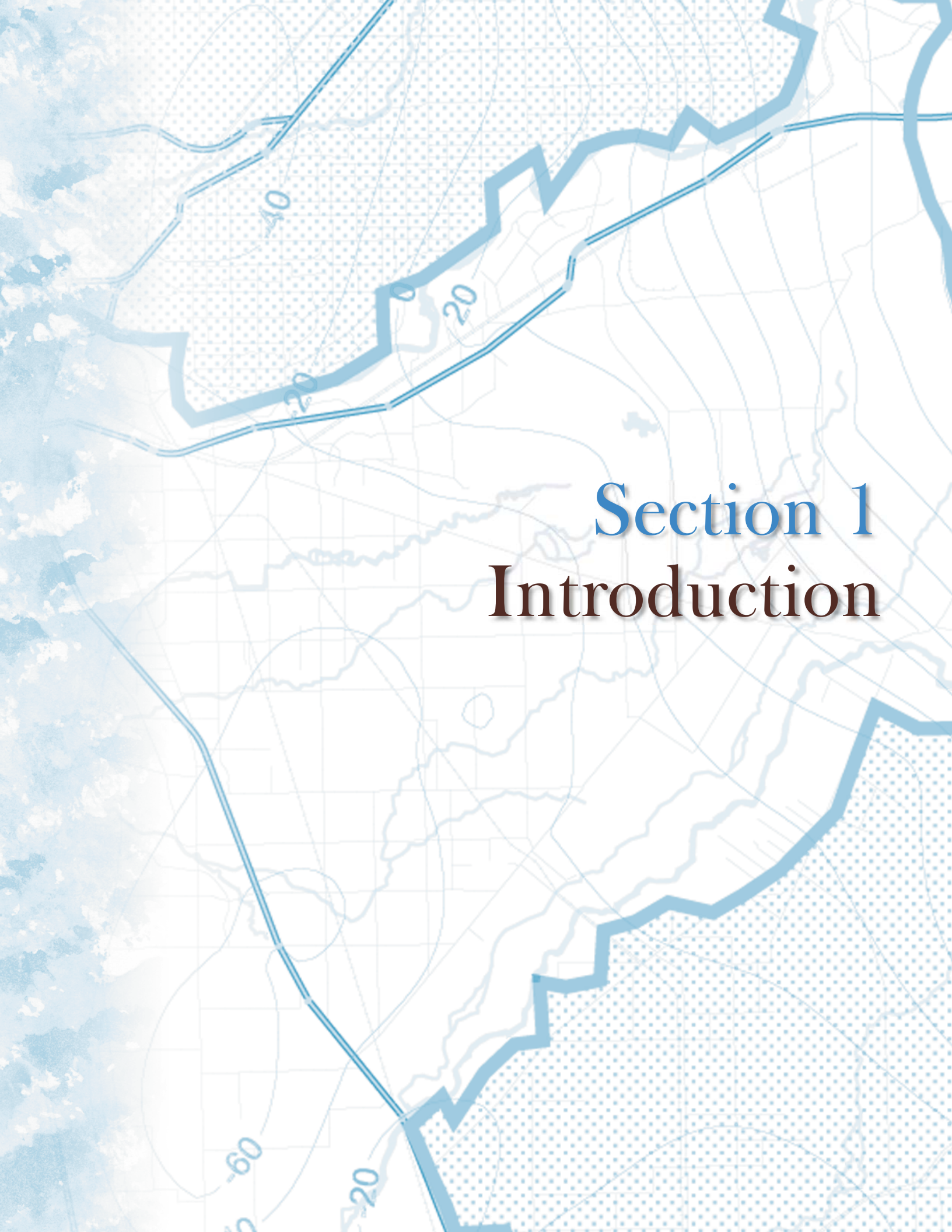


Section 1
Introduction

Introduction

Section 1

Groundwater in central Sacramento County has many users and uses. To help protect the health and viability of the groundwater subbasin in central Sacramento County (Central Basin), interested groups (stakeholders) have come together under the aegis of the Sacramento Area Water Forum Successor Effort to create the Central Sacramento County Groundwater Forum (CSCGF).

Acting on behalf of the Water Forum Successor Effort, the Sacramento City-County Office of Water Planning entered into a Memorandum of Understanding with the California Department of Water Resources (DWR) to support discussions among stakeholders representing all segments of the community with an interest in developing a groundwater management plan for the Central Basin. Stakeholders were selected as a result of an area-wide assessment performed to identify concerns and develop a program for the stakeholders to work together. Interviews were held with 100 stakeholders, and as a result, 6 interest groups were identified: agricultural and agricultural-residential groundwater users, business, environmental/community organizations, local governments/public agencies, and water purveyors. Each interest group is represented by five individuals, who participated in designing the collaborative process now known as CSCGF.

Under the sponsorship of the Water Forum Successor Effort, CSCGF is working to develop recommendations for sustaining Central Basin groundwater as a resource for the community and the environment. As part of CSCGF's efforts, information about Central Basin groundwater was presented in monthly meetings during an education phase to help participants reach a common understanding of current conditions in the Central Basin. In the next phase, stakeholders must negotiate how groundwater in the Central Basin will be managed. To prepare for those discussions, stakeholders may want to review information provided during the education phase. Therefore, this Groundwater Digest summarizes educational material presented since February 2002 and also responds to "frequently asked questions" collected during the meetings and summarized below.

Central Basin
Common name for the groundwater subbasin in the central portion of Sacramento County.

stakeholders
Persons, agencies, groups, or other interested parties who have a "stake" in a common issue, project, etc.

CSCGF
Central Sacramento County Groundwater Forum
A group of stakeholders formed under the aegis of the Water Forum Successor Effort to develop recommendations for Central Basin groundwater.

DWR
California Department of Water Resources
State agency responsible for managing the water resources of California in cooperation with other agencies to benefit California residents and to protect, restore, and enhance the natural and human environments.

Central Sacramento County Groundwater Forum
CSCGF is working to develop mutually agreed upon recommendations for sustaining Central Basin groundwater as a resource for the community and the environment. These recommendations will be presented to the Water Forum Successor Effort for review and approval and forwarded to the relevant public agencies for implementation, as appropriate.

Summary of Frequently Asked Questions

Facts and Figures

Many questions were asked about the Central Basin, groundwater, groundwater agencies, concepts, use, and levels, and land use. Section 2 discusses these topics and reviews facts and figures presented during CSCGF meetings.

How would groundwater be managed?

Many questions were also asked about how groundwater would be managed. Groundwater management options are discussed in Section 4. However, stakeholders will determine, in an interest-based negotiation process, how Central Basin groundwater will be managed within the framework of the management option they choose.

Will groundwater management encourage development?

Concern was expressed that groundwater management would favor development and it was suggested that development could be restricted. However, land use decisions ultimately control growth. Such decisions are the prerogative of Sacramento County and the cities located within the Central Basin. Groundwater management is essential to protect the long-term viability of the Central Basin for any growth scenarios adopted by the cities and Sacramento County. Again, stakeholders are responsible for setting the parameters of groundwater management for the Central Basin. Since CSCGF includes members representing all segments of the community that have an interest in groundwater, a broad diversity of interests are represented in the negotiation process. See section 4 for a description of various groundwater management options.

How will groundwater management affect groundwater wells?

Questions were asked about the effect of management on groundwater levels and wells, whether groundwater users would incur costs, and if wells would be metered. Section 2 discusses recharge and sustainable yield; decisions about costs and metering will be made by the stakeholders who negotiate the groundwater management plan (Section 4).

How will groundwater management address contamination?

Groundwater contamination in the Central Basin and specific contaminated sites were subjects of concern and many questions. Section 2 briefly discusses locations and types of contamination and a groundwater contamination investigation that will be performed to provide current and detailed information on contaminants in the Central Basin.

Can conservation, recycling, water purchases/sales, and water storage help meet water supply needs?

See Section 2 of the Groundwater Digest.

How will groundwater management affect the Cosumnes River and other natural resources?

Section 1 discusses support for Cosumnes River restoration efforts as a potential advantage of groundwater management; Section 2 explains basin recharge, contains a figure showing the Cosumnes River and other rivers in the Central Basin, and discusses recharge in terms of sustainable yield.

Organization of the Groundwater Digest

The Groundwater Digest is divided into the following four sections:

Introduction – Presents the purpose of the Groundwater Digest and a summary of frequently asked questions, and describes the organization of the digest.

Facts and Figures – Briefly summarizes the Water Forum Agreement, discusses the advantages and disadvantages of groundwater management, and contains a primer of groundwater terms and concepts.

Groundwater Rights – Lists and defines various types of rights exercised over water in the State of California.

Governance Options – Lists five governance methods that could be used to manage groundwater and gives details on three methods that may be the most feasible for the Central Basin.

Supplemental information includes the following:

References – Contains sources used in writing this document.

Frequently Asked Questions – Contains a list of "frequently asked questions" sorted into categories.

Glossary – Contains definitions of terms that are highlighted in the text in brown and includes definitions or explanations of other terms that are important when discussing groundwater and groundwater management.

Section 2
Facts and Figures

Facts and Figures

Section 2

This section describes the Water Forum Agreement, which provides for developing a groundwater management program in the Central Basin. Advantages and disadvantages of groundwater management are listed, and important groundwater terms and concepts are discussed.

Water Forum Agreement

The Water Forum Agreement was negotiated over 6 years by the Water Forum, a diverse group of business and agricultural leaders, citizen groups, environmentalists, water managers, and local governments in the Sacramento region. The Water Forum Agreement has two coequal objectives: 1) to provide a reliable and safe water supply for the region's economic health and planned development through 2030, and 2) to preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.

The Water Forum also negotiated recommendations for sustainable yield (the amount of groundwater that can be safely pumped from a basin on a long-term average annual basis without damaging the aquifer) for the north, central, and south (Galt) area groundwater subbasins in Sacramento County. (Sustainable yield for the Central Basin is discussed at the end of this section.)

The groundwater management element of the Water Forum Agreement outlines groundwater management recommendations for the Sacramento North Area Groundwater Management Authority, now known as the Sacramento Groundwater Authority (SGA), which manages groundwater in the north area subbasin. (These recommendations are not a "template" to be imposed on the Central Basin.)

In addition, the Water Forum Agreement calls for an interest-based negotiation process to allow all parts of the community to participate in developing groundwater management measures for the Central Basin. This stipulation in the Water Forum Agreement led to creation of the CSCGF under the sponsorship of the Water Forum Successor Effort.

Water Forum Agreement
An agreement negotiated over 6 years by a diverse group of stakeholders in the Sacramento region.

Water Forum
Diverse group formed to develop and implement a plan to ensure the region's water supply needs to 2030 while preserving the ecosystem of the Lower American River.

sustainable yield
The amount of groundwater that can be safely pumped from a basin on a long-term average annual basis without damaging the aquifer.

SGA
Sacramento Groundwater Authority
The groundwater management element of the Water Forum Agreement led to creation of the SGA. This agency is responsible for managing groundwater in the north area subbasin of Sacramento County.

Water Forum Successor Effort
This group was formed after the Water Forum Agreement was signed to carry forward the agreement and address changed conditions. Members of the group represent stakeholders who signed the Water Forum Agreement.

Advantages/Disadvantages of Groundwater Management

Without viable groundwater management measures, Central Basin stakeholders can expect:

- **Declining groundwater levels**
- **Increased pumping costs**
- **Accelerated movement of toxic plumes**
- **Increased water treatment costs**
- **Possible permanent damage to the groundwater aquifer**
- **Further reduction in flow for the Cosumnes River and other rivers and streams in the Central Basin**

With an agreed-on groundwater management plan that achieves a sustainable yield, stakeholders can:

- **Stabilize groundwater levels**
- **Maintain water quality**
- **Ensure long-term viability of the groundwater aquifer**
- **Meet existing and future water demands**
- **Coordinate with and support Cosumnes River restoration efforts**

Figure 1 illustrates historic groundwater elevations near the cone of depression. Stabilized groundwater elevations are projected through 2030, with and without groundwater management.

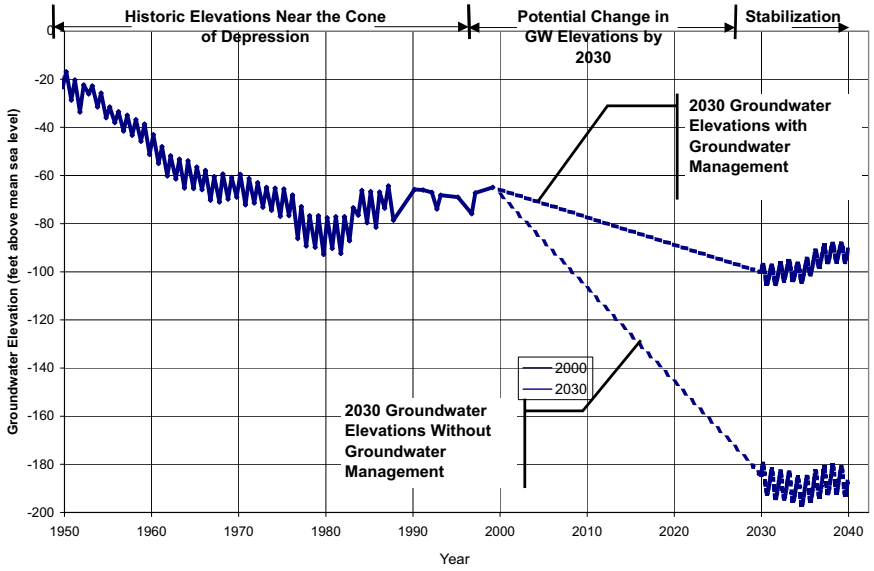


Figure 1. Example of Estimated Benefits from Groundwater Management for the Central Basin

Primer of Groundwater Terms and Concepts

To discuss groundwater management, it is helpful to know and understand general groundwater terms and concepts, and information specific to the Central Basin. The remainder of this section contains educational material presented in CSCGF meetings, and other relevant facts and figures.

Central Basin

Where is the Central Basin?

hydrology
Science that deals with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere.

hydrogeology
Science that deals with subsurface waters and related geologic aspects of surface waters.

watershed
Region that is drained by, or contributes to, streams, lakes, rivers, or other bodies of water.

DWR Groundwater Basins
Based on **hydrology** and **hydrogeology**, DWR has identified and numbered the groundwater basins in California, including the basin in Sacramento County:

- Name: Sacramento Valley Groundwater Basin
- Groundwater Basin Number: 5-21.65
- Surface Area: 248,000 acres (388 square miles)

DWR has also named subbasins within Sacramento County: the "Central Basin" lies within the South American Subbasin of Basin Number 5-21.65.

Source: DWR, 2003

For purposes of groundwater management, the Water Forum divided the groundwater basin in Sacramento County into three subbasins: north, central, and south (Galt), as shown in **Figures 2 and 3**. The subbasin in the central area of the groundwater basin, known as the "Central Basin," lies south of the American River, east of Interstate 5 and the Sacramento River, and north of the southern boundary of the Omochumne-Hartnell Water District and the Cosumnes River. The eastern boundary of the Central Basin is approximately 5 to 6 miles west of the Sacramento County-El Dorado County border, where the Sierra Nevada foothills begin to rise up from the Central Valley floor.

The Central Basin falls within the 27,000-square-mile Sacramento River Watershed, one of the largest watersheds in the United States, draining the Sacramento Valley, Modoc Plateau, and parts of the Cascade Range and Sierra Nevada Range.

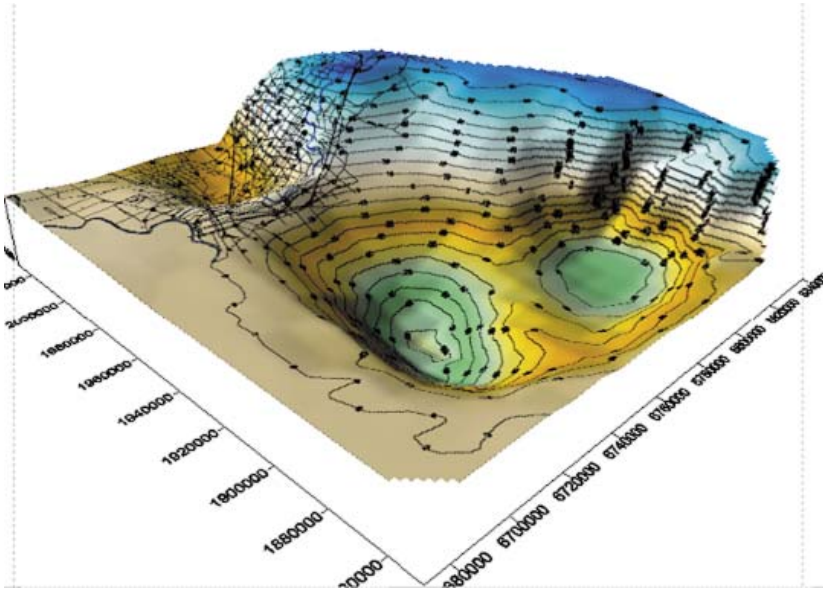


Figure 2. Three-Dimensional Representation of Sacramento County Groundwater Subbasins

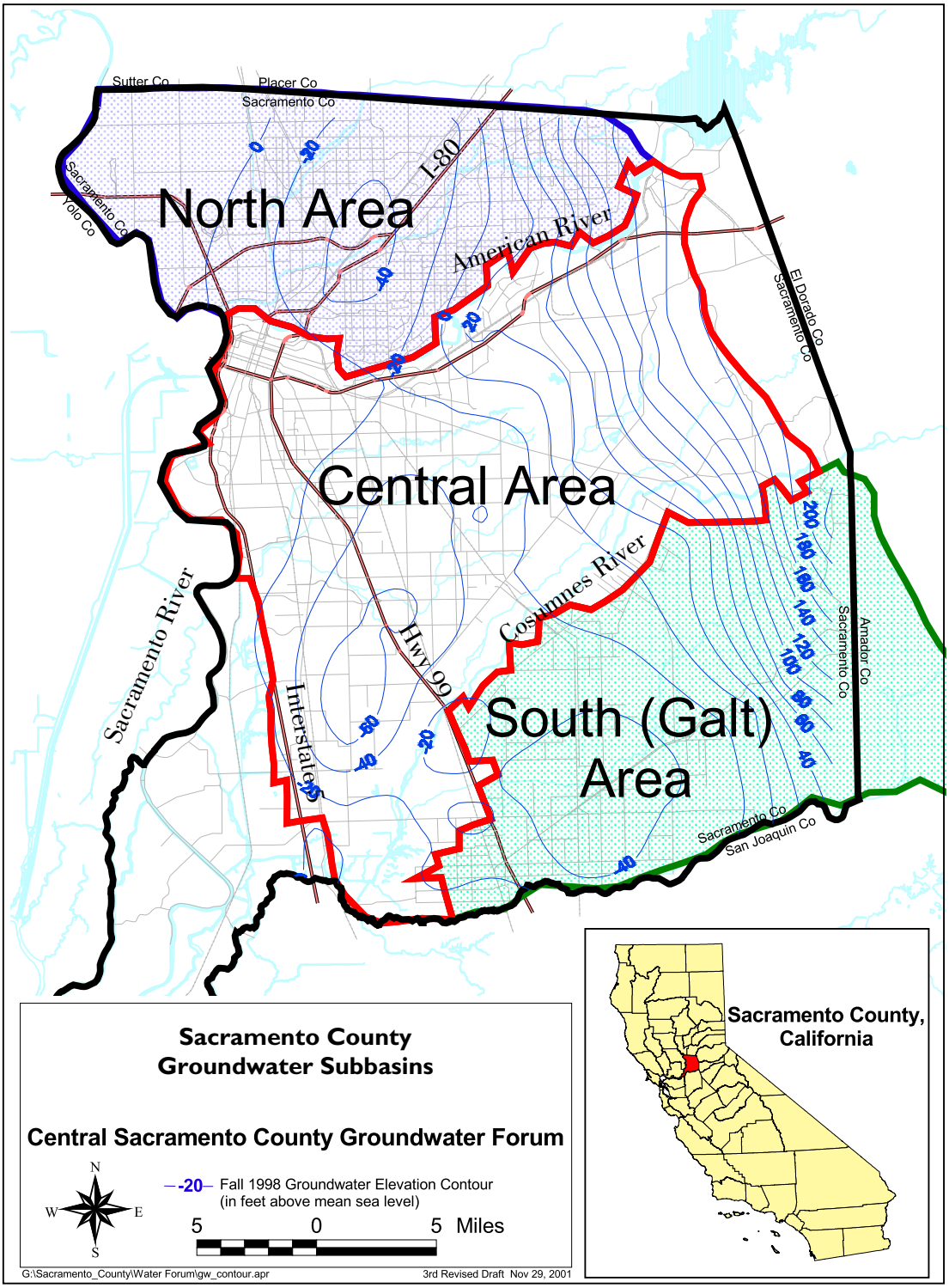


Figure 3. Location of Groundwater Subbasins in Sacramento County

Groundwater

How does a basin hold groundwater?

groundwater
Water stored in the pore spaces of rocks or unconsolidated deposits found in the saturated zone of an aquifer.

consolidated rock
Mineral particles of different sizes and shapes that have been welded together into a solid mass by heat and pressure or chemical reactions. Examples of rocks important for groundwater include limestone, dolomite, shale, siltstone, sandstone, and conglomerate.

unconsolidated deposit
Material consisting of particles of rocks or minerals ranging in size from clay to boulders. Examples of unconsolidated deposits important for groundwater are clay, silt, sand, gravel, and cobble (in order of increasing grain size).

alluvial deposit
Clay, silt, sand, gravel, or cobble deposited by rivers and streams over long periods of time.

porosity
Volume of open pore space between particles of clay, silt, sand, gravel, or cobble in a geologic formation, usually expressed as a percentage.

geologic formation
Set of rocks or unconsolidated deposits that forms a unit and may be dominated by a certain type of deposit or rock, or may have some other common feature.

Because groundwater is hidden from view below the earth's surface, it is not always well understood. Groundwater does not occur in underground streams or rivers; instead, it is stored in the pore spaces of some kinds of consolidated rocks (rocks) and unconsolidated deposits. Examples of rocks that can store water are limestone, shale, and sandstone. Most unconsolidated deposits come from the disintegration of rocks, which yields minerals or rock particles that can vary widely in size. Unconsolidated deposits that are water-bearing include clay, silt, sand, gravel, and cobble. When these deposits are laid down by flowing water (streams or rivers) over a long time, they are called alluvial deposits. Some rocks or unconsolidated deposits have more or larger pore spaces (porosity) than others and can hold more water.

A geologic formation is a set of rocks or unconsolidated deposits that forms a unit and may be dominated by a certain type of rock or deposit, or may have some other common feature. Some geologic formations occur in layers and others are very heterogeneous and discontinuous in nature, such as the alluvial deposits of the Central Basin.

Groundwater (cont'd)

aquifer
Geologic formation that is water-bearing and permeable and yields economically significant amounts of water to wells or springs.

permeability
For groundwater, the ability of a rock or unconsolidated deposit to transmit water through spaces that connect between grains. The size and shape of the spaces controls how well water transmits or "flows." Usually expressed in millidarcies.

semipermeable
In a formation, having small preferential flow paths through mostly impermeable material.

An aquifer is a geologic formation that is water-bearing and permeable, which means the spaces between the grains must connect so that groundwater can "flow" between and thus be yielded or "transmitted" to wells and springs. The size and shape of the pore spaces controls the ability of the deposits to transmit groundwater (**Figure 4**). Permeability can vary greatly, ranging from highly permeable unconsolidated deposits, such as gravels, to silts and clays, which have low permeability. Semipermeable formations have small, preferential flow paths for groundwater through mostly impermeable material.

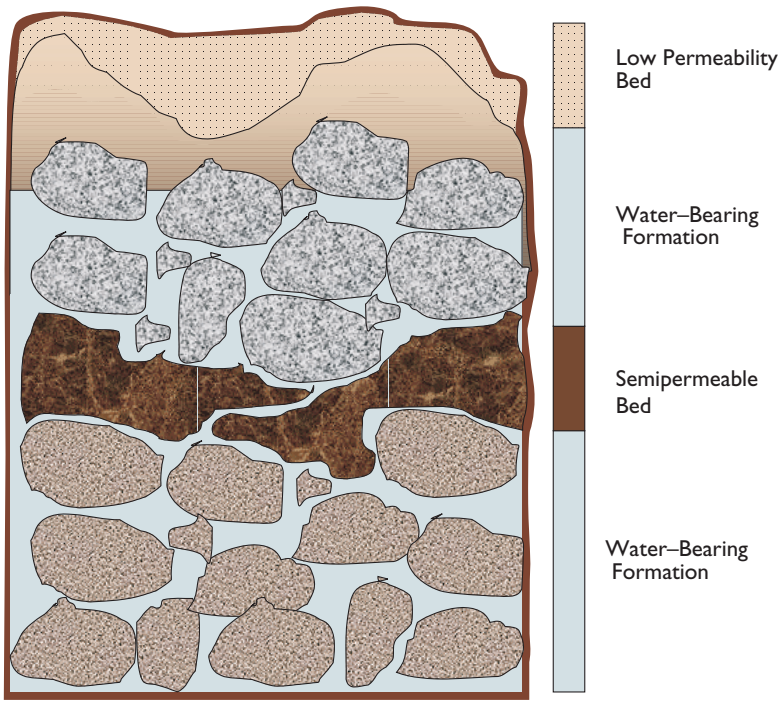


Figure 4. Elements of an Aquifer

Groundwater (cont'd)

Above aquifers are unsaturated zones, which lie just below the land surface and contain both air and water; water in unsaturated zones is referred to as subsurface water. Aquifers are saturated, meaning only water is present in the interconnected spaces, and only this water in the saturated zone is correctly termed groundwater. Between the unsaturated and saturated zones of an aquifer lies a transition zone. The water table is the level in the saturated zone where pressure from the air and pressure from the water are equal **(Figure 5)**.

unsaturated zone
Zone that lies just below the land surface and contains both air and water.

subsurface water
Water under the surface of the earth.

saturated zone
Zone with only water in the interconnected spaces.

transition zone
Lies between the unsaturated and saturated zones of an aquifer.

water table
Level in the saturated zone of an aquifer where the pressure from the air and the pressure from the water are equal. In an unconfined aquifer, the water table is the top of the saturated zone and the bottom of the unsaturated zone.

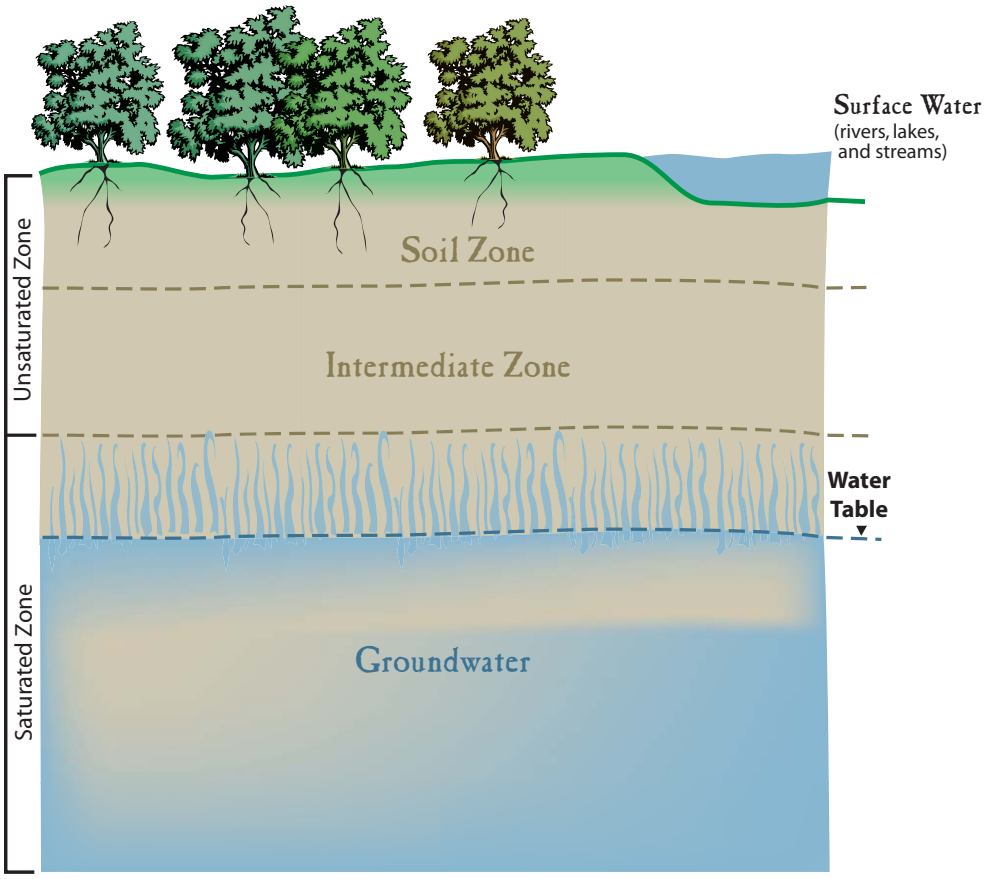


Figure 5. Saturated and Unsaturated Zones in an Aquifer

Groundwater (cont'd)

unconfined aquifer
Aquifer without a confining layer at the top; therefore, a corresponding lack of pressure allows the water level to rise or fall.

confined aquifer
Has a confining layer at the top, causing the groundwater to be under pressure.

Aquifers can be unconfined, confined, or semiconfined **(Figure 6)**:

Unconfined aquifer. The level of water in an unconfined aquifer can rise or fall because there is no confining layer (layer with low permeability) at the top and the groundwater is not under pressure. In an unconfined aquifer, the water table is the top of the saturated zone and the bottom of the unsaturated zone. The water level in an unconfined aquifer well shows the level of the water table in the surrounding aquifer.

Confined aquifer. A confined aquifer has a confining layer at the top, causing the groundwater to be under pressure. Because of this pressure, the water level in a confined aquifer well is above the top of the aquifer, and sometimes even above the land surface.

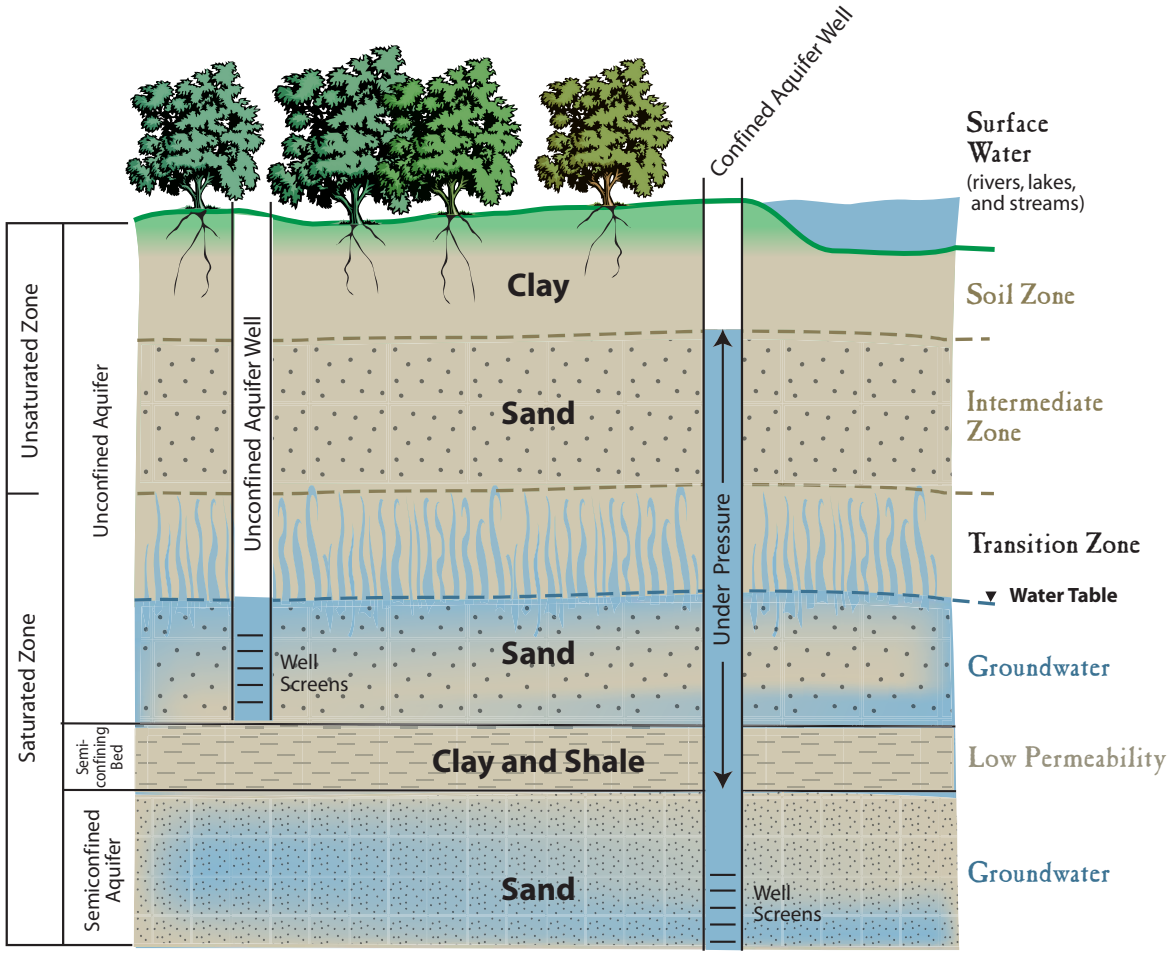


Figure 6. Types of Aquifers

Groundwater (cont'd)

Semiconfined aquifer. Semiconfined aquifers are confined by upper layers with permeability that varies from low to moderate. Thus, groundwater moves through these confining layers, but moves slowly.

An aquifer system is a regional set of interbedded geologic formations within a groundwater basin. Some formations are very permeable and transmit water quickly and others have very low permeability and transmit water more slowly; however, the formations are water-bearing as a whole.

Aquifers and aquifer systems are found in groundwater basins, which are flow systems that have a surface and a subsurface area with defined boundaries, and materials that can store water.

Geologic formations that contain groundwater in the Central Basin include the Riverbank (formerly known as Victor) and Turlock Lake/Laguna (formerly known as Fair Oaks-Laguna) formations, which together make up an upper, unconfined aquifer system, and the Mehrten Formation, which is a lower, semiconfined aquifer system. These aquifer systems are typically composed of lenses of interbedded sand, silt, and clay interlaced with coarse-grained stream channel deposits; the layers form a wedge that generally thickens from east to west at a constant rate to a maximum thickness of about 2,000 feet under the Sacramento River (**Figure 7**).

The Central Basin is described as having an unconfined and semiconfined aquifer system. Groundwater wells in the Central Basin are generally 100 feet to 1,500 feet deep, and yield water from both the unconfined and semiconfined aquifer systems.

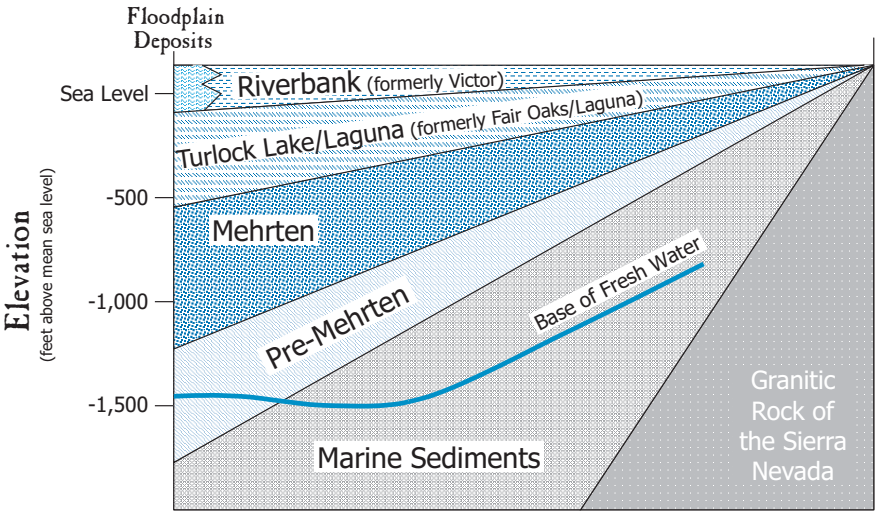


Figure 7. Central Basin Geologic Formations

semiconfined aquifer
Confined by upper layers having permeability that varies from low to moderate. Thus, groundwater moves through these confining layers, but moves slowly.

aquifer system
Regional set of interbedded geologic formations within a groundwater basin.

interbedded
Beds lying between or alternating with others of a different type.

groundwater basin
Flow system that has a surface and a subsurface area with defined boundaries, and materials (rocks or unconsolidated deposits) that can store water.

Land Use

How does land use relate to groundwater use in the Central Basin?

Historically, land in the Central Basin has been used for the following purposes:

- **Agricultural** ("ag") – properties of more than 5 acres, typically used for row crops, vineyards, grazing, etc.
- **Agricultural-residential** ("ag-res") – small farms or residential properties generally 5 acres or less
- **Municipal and industrial** (M&I) – urban or industrial development
- Conservation reserves and native lands – land along waterways and in other areas that is set aside and protected, and undeveloped land, respectively

In the past, ag activities were the primary land use in the Central Basin requiring water; groundwater supplied most of the water used by ag. Today, while much of the land in the Central Basin remains ag or ag-res property, M&I, formerly a minor land use category, has grown to be the Central Basin's largest land use requiring water supply (**Figure 8**).

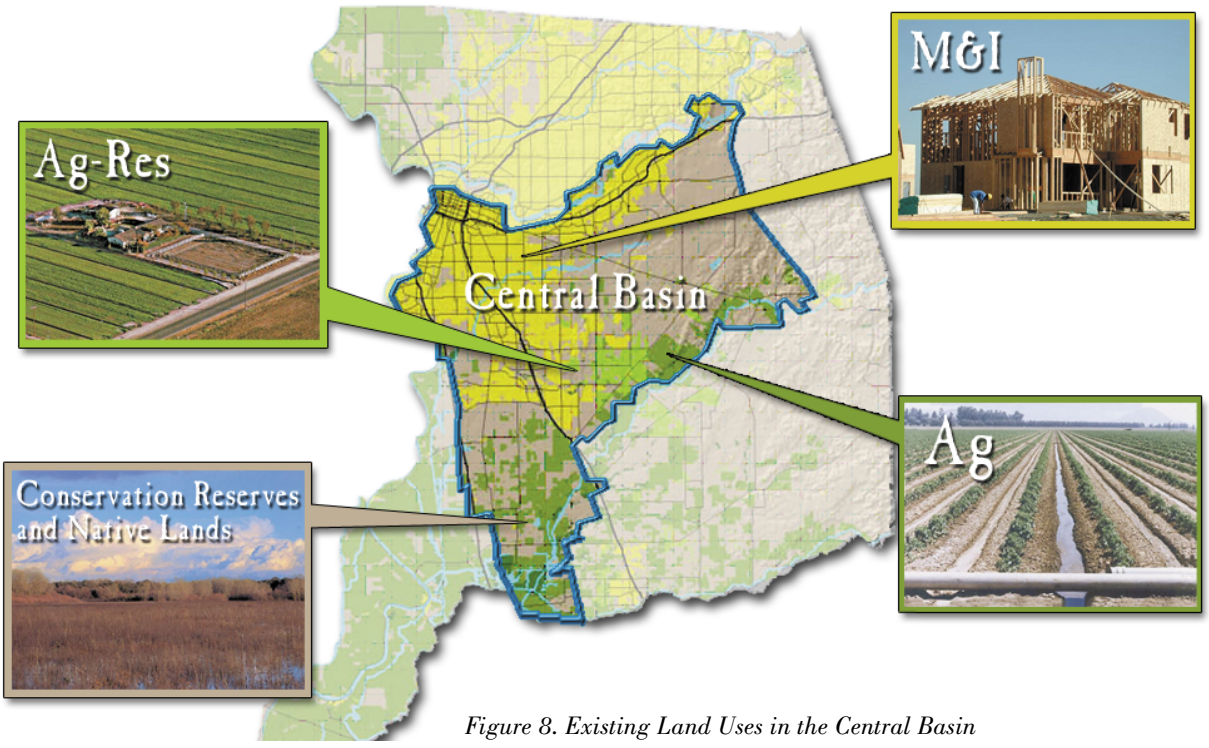


Figure 8. Existing Land Uses in the Central Basin

Changes in the Central Basin

How are land use and water demand changing in the Central Basin?

Sacramento County's 1993 General Plan, approved by the Sacramento County Board of Supervisors, provides for additional urban development within its Urban Policy Area to meet projected population growth until 2024. Other incorporated cities in Sacramento County also have approved similar General Plans to account for future development. **Figure 9** shows Sacramento County land uses projected for 2024 (the Water Forum adds 6 more years to this date, using 2030 for planning), including urban growth boundaries. The planning horizons of the General Plan and Water Forum Agreement recognize development of designated urban areas.

General Plan
Document used by Sacramento County and incorporated cities to plan for providing infrastructure for future development within identified boundaries.

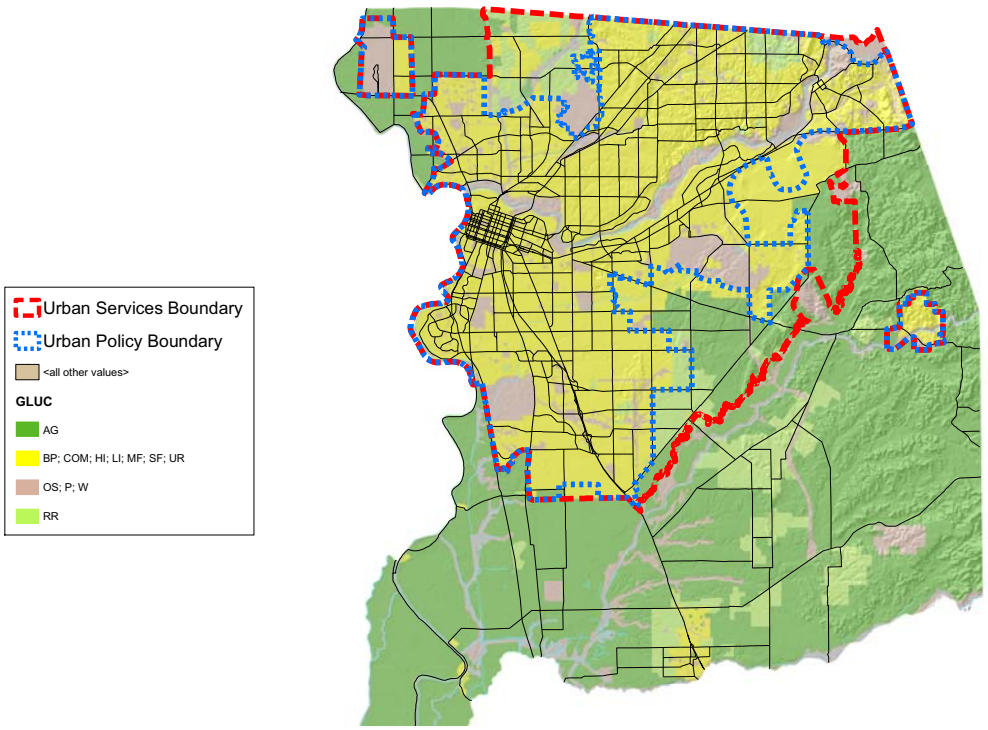


Figure 9. Sacramento County Land Use and Approved General Plan Development Boundaries Projected for Development Through 2024.

Changes in the Central Basin (cont'd)

Given the adopted General Plans, the trend of converting ag and ag-res land to M&I uses will likely continue, with the population of the Central Basin projected to increase 52 percent by 2025, according to population projections of the Sacramento Area Council of Governments.

The Central Basin is served by 11 water purveyors (**Figure 10**); however, a large portion of the Central Basin is not served by any organized water purveyor. The unserved areas include over 6,000 self-supplied ag and ag-res groundwater users.

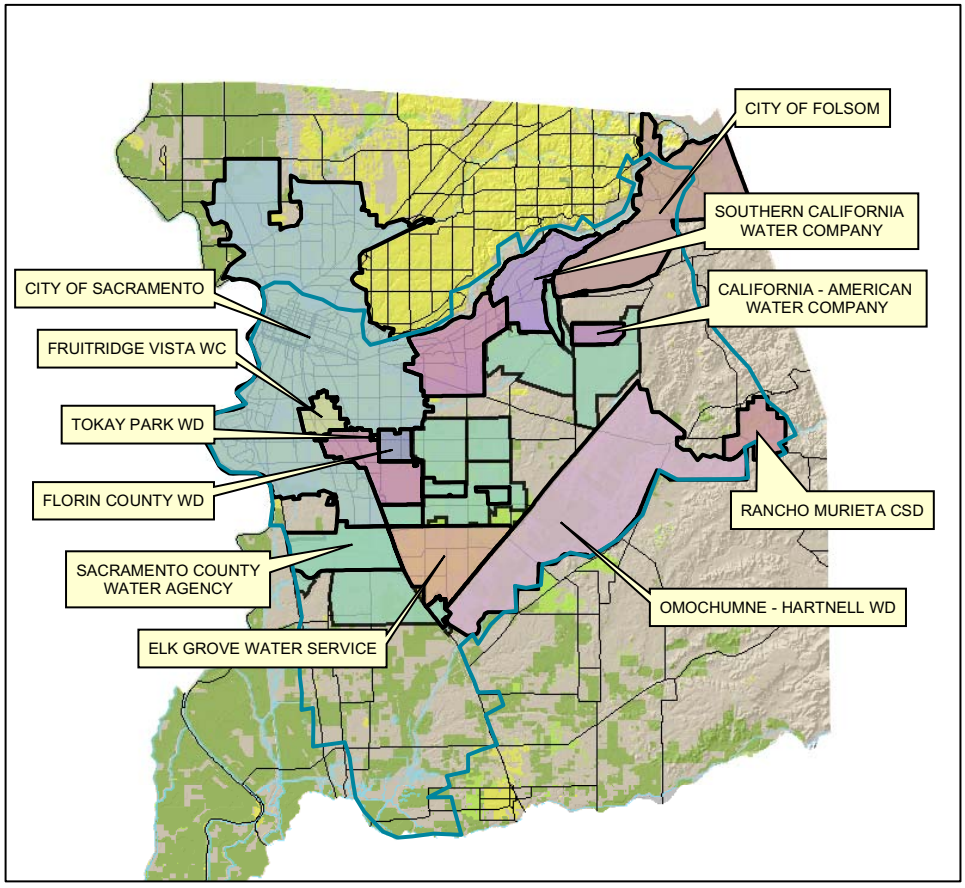


Figure 10. Water District Service Areas Within the Central Basin

Changes in the Central Basin (cont'd)

Current acreages for ag, ag-res, M&I, and conservation land uses in Sacramento County are shown in **Table 1** with acreages for development through 2024 and net increases/decreases in acreage.

About two-thirds of the water used in the Central Basin area comes from groundwater. While water use varies based on annual weather conditions, in 1990 about 250,000 acre-feet of groundwater were pumped for ag, ag-res, M&I, and environmental uses. **Figure 11** shows historical groundwater pumping for ag, ag-res, and M&I uses in the Central Basin. Looking into the future, under the provisions of the currently approved General Plan, significant increases will occur for M&I demand.

acre-foot
Amount of water it takes to cover an acre of land to a depth of 1 foot; about 326,000 gallons. An acre-foot can supply the annual needs of between one and two average California households.

Table 1. Current and Projected Land Use in Sacramento County

Land-Use Category	Current Conditions 2000 (acres)	General Plan Development Through 2024 (acres)	Net Increase or Decrease (acres)
Ag	53,269	45,054	-8,215
Ag-Res	5,418	21,144	+15,726
M&I (urban)	80,398	116,042	+35,644
Conservation Reserves and Native Lands[1]	108,101	64,946	-43,155
Total Area	247,186	247,186	0

[1]*Native land is undeveloped land (i.e., not urban, ag, etc.)*

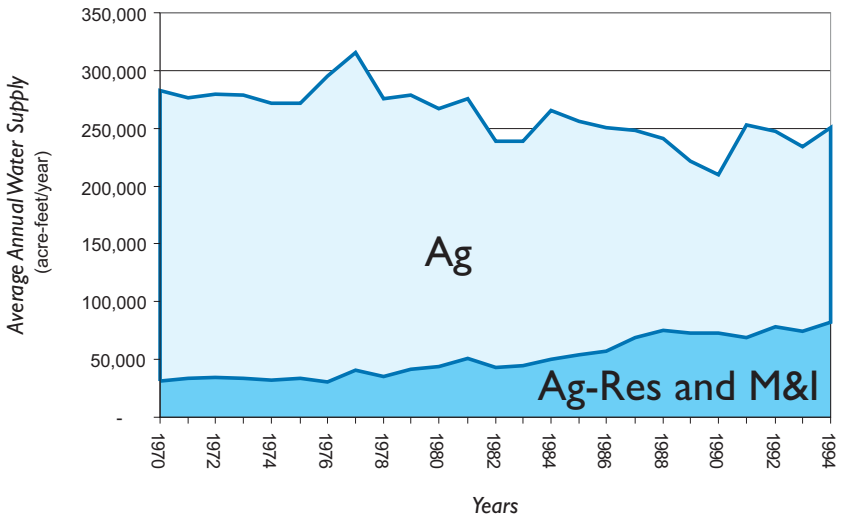


Figure 11. Historical Pumping in the Central Basin

Conjunctive Use

What is conjunctive use?

Groundwater can supplement surface water supplies, and through conjunctive use of both, a reliable water supply can be maintained. The estimated mix of surface water and groundwater in 1995 for the Central Basin (based on a Sacramento County groundwater model) was 60,000 acre-feet/year and 215,000 acre-feet/year, respectively. **Figure 12** illustrates where surface and groundwater are used separately or together (conjunctive operation) in the Central Basin.

surface water
All waters on the surface of the earth, including fresh water (streams, rivers, lakes), saltwater, ice, and snow.

conjunctive use
Coordinated management of surface water and groundwater supplies to increase the yield of both. Conjunctive use is intended to increase total supplies and enhance water supply reliability.

conjunctive operation
The operation of a groundwater basin in combination with surface water. Groundwater is stored in the basin for later use by intentionally recharging the basin during years of above-average surface water supply.

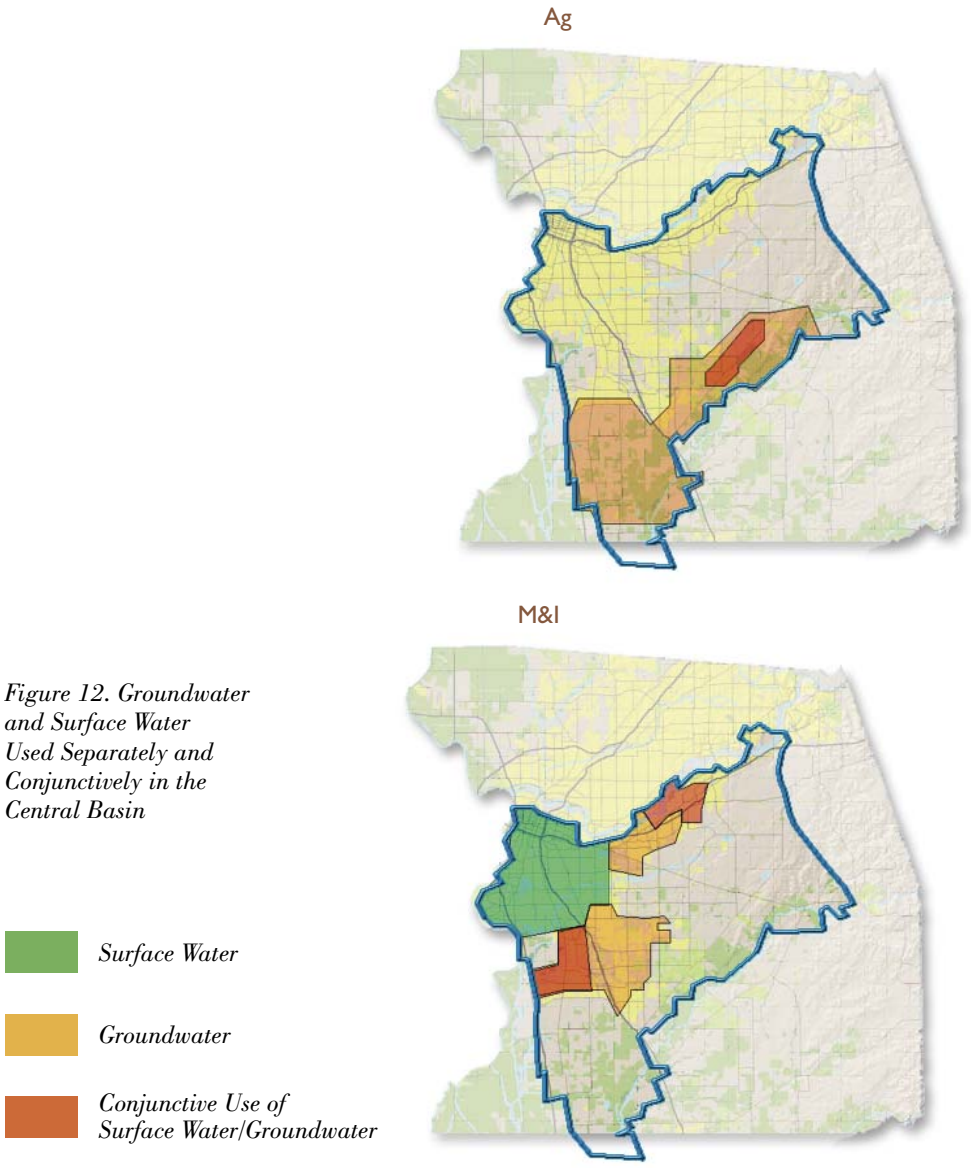


Figure 12. Groundwater and Surface Water Used Separately and Conjunctively in the Central Basin

Basin Recharge

How is a basin recharged?

recharge
When water reaches the saturated zone of an aquifer, where it is available for extraction.

surface water recharge
Recharge from rainfall that percolates down to aquifers, and from rivers and streams that may or may not be connected to the water table. Surface water is always recharging groundwater. One result of this continuous recharge is that groundwater can be contaminated from land use practices at the surface.

percolation
Movement of water through small openings (pore space) within a porous material.

hydraulic connection
When surface water and groundwater are connected (allows groundwater to be recharged). Can also refer to a connection between two aquifer zones.

mountain front recharge
When precipitation and runoff enter geologic formations that are exposed along the front of mountains and this water travels into aquifers via the formations.

atificial recharge
When surface water is added to a groundwater basin by human activity.

surface spreading basin
Basin above an aquifer that is filled with water in areas of good percolation.

dual-purpose well
Groundwater well that is used for both extraction and injection.

in-lieu recharge
Indirect method of recharge - groundwater users use excess surface water in lieu of groundwater.

cone of depression
A depression of the water table surface in the shape of an inverted cone. Localized cones of depression develop around a well or wells that are being pumped. Regional cones of depression occur from long-term pumping in a groundwater basin.

Before any pumping occurs, a groundwater basin is in a state of equilibrium, or balance. In this state, groundwater tends to move slowly from points of entry (known as recharge areas) to points of exit (discharge areas). (The approximate rate of groundwater movement in the Central Basin is 200 feet to 1,500 feet per year and groundwater levels fluctuate gradually during "wet" and "dry" periods.) The basin is recharged, or refilled, by several methods:

- Surface water recharge from rainfall that percolates down to aquifers, and from rivers and streams that may or may not be connected to the water table (hydraulic connection).
- Mountain front recharge, when precipitation and runoff enter geologic formations that are exposed along the front of mountains and this water travels into aquifers via the formations.
- Artificial recharge, which occurs as a result of human activity. Types of artificial recharge include filling surface spreading basins above aquifers with water in areas of good percolation, using dual-purpose wells to inject water as well as extract it, using recycled water for recharge, and practicing in-lieu recharge, an indirect method of recharge (groundwater users use excess surface water in lieu of groundwater).

It is only through long-term persistent pumping that groundwater elevations change over time. When a well is drilled into a basin, water is initially extracted from aquifer storage around the well, creating a localized cone of depression that moves up and down with well operations. Over time, the well creates a small incremental decline in the overall groundwater basin, increasing recharge, or refill, from rivers with a hydraulic connection to the water table. Regional pumping creates greater declines in an overall groundwater basin, as shown in **Figure 13** for the Central Basin.

Basin Recharge (cont'd)

overdraft
Over a period of years, withdrawing from an aquifer (on purpose or inadvertently) more water than the amount of water recharging a basin.

To achieve recharge, and refill the basin, enough recharge water must be available to balance the groundwater system. If more water is pumped than is available for recharge, the basin enters a state of "overdraft." The period of time needed to balance the groundwater system between pumping and recharge is typically measured in decades.

Changes in the groundwater surface elevation result from changes in groundwater recharge, discharge, or extraction. In some instances within the Central Basin, this movement can induce natural recharge at locations where the river and aquifer are hydraulically connected, as shown in Figure 13a. To the extent that a hydraulic connection exists, as groundwater conditions change, the slope or gradient of the groundwater surface away from the river may change as well. A steeper gradient away from the river can induce additional recharge from the rivers. The rate of recharge from rivers that are hydraulically disconnected from the groundwater surface is indifferent to changes in groundwater elevations or gradient. This is typically true with smaller streams where the groundwater surface is located far below the streambed. In such cases, surface water percolates through the unsaturated zone to the groundwater and is a function of the aquifer materials underlying the streambed. As mentioned above, the rate of infiltration under these conditions is not governed by the gradient of the underlying groundwater. There is also some evidence to suggest these conditions exist along the Cosumnes River.

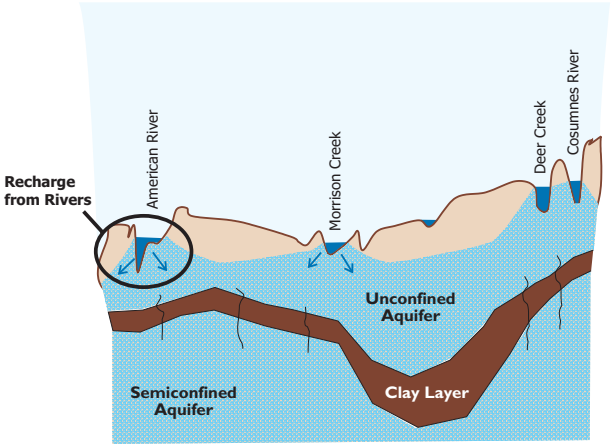


Figure 13a. Prior to pumping: groundwater flow through the basin equals the rate of recharge from rivers, streams, and precipitation.

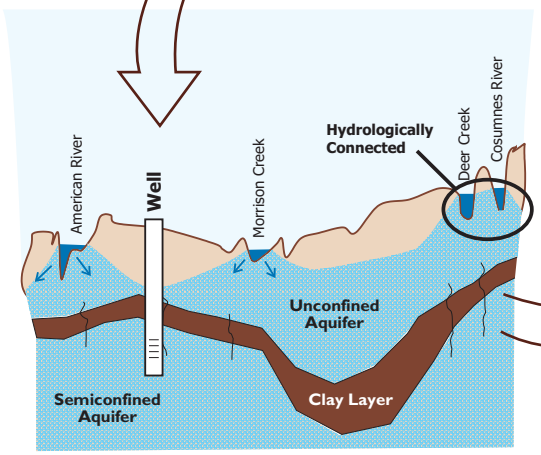


Figure 13b. Single well: localized cone of depression near pumping well.

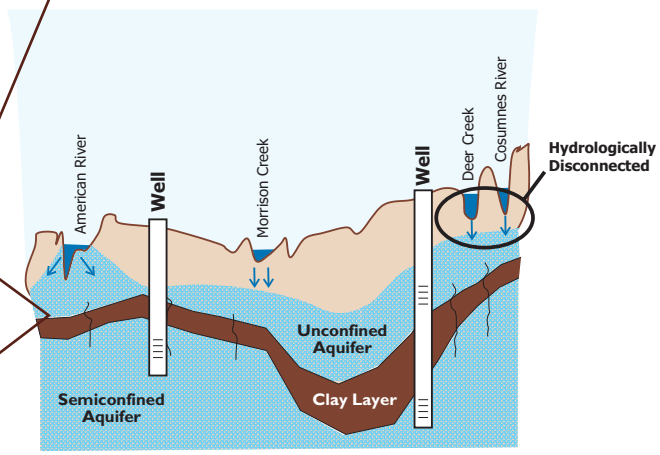


Figure 13c. Regional pumping: regional reduction in groundwater elevation.

Figure 13. Effects of Pumping in the Central Basin

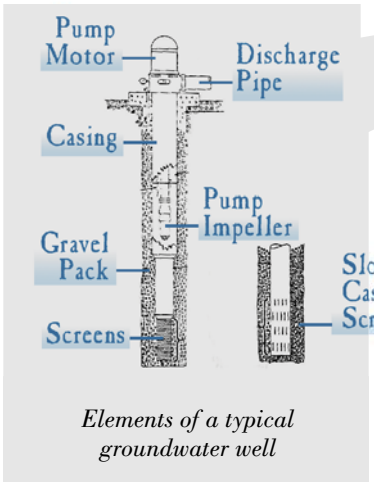
Extracting Water

How is groundwater taken out of the Central Basin?

Groundwater wells are used to pump water from the aquifers of the Central Basin. Wells are drilled from 100 feet to 1,500 feet deep and are owned by both public and private users. Various amounts of water are pumped to serve ag, ag-res, and M&I customers of organized water districts. The type of user typically dictates the location of a well and its depth of extraction. Well characteristics for each groundwater user group are listed in **Table 2** and shown in **Figure 14**, along with a diagram of how a typical groundwater well is constructed.

Table 2. Well Characteristics for Central Basin Groundwater Wells

Well Type	Diameter (inches)	Depth (feet)	Capacity (gallons per minute)	Approx No.
Ag-Res	4-8	191-300	344	4,950
Ag	12-16	60-600	970	320
M&I	12-16	400-1,000	400-2,000	160



Elements of a typical groundwater well

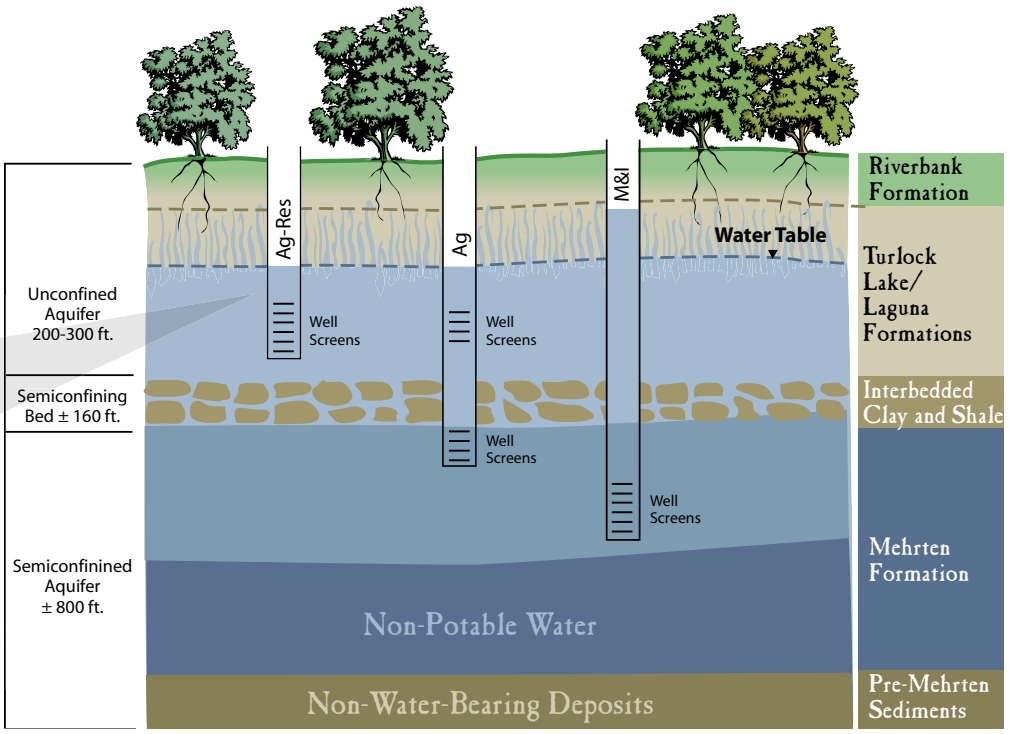


Figure 14. Types of Groundwater Wells in the Central Basin According to Well Use

Sustainable Yield

What is sustainable yield?

Sustainable yield is a balance between pumping and basin recharge and is expressed as the number of acre-feet of water per year that can be safely pumped from the basin on a long-term average annual basis without damaging the aquifer. The Water Forum Agreement contains a specific recommendation concerning sustainable yield for the Central Basin: 273,000 acre-feet/year. Pumping this amount will result in a further decline in groundwater levels of approximately 50 feet at the deepest point of the existing cone of depression. The following are important facts about the recommended sustainable yield for the Central Basin.

land subsidence
The lowering of the natural land surface in response to a lower groundwater level. Caused by removal of groundwater and subsequent consolidation of certain soil types.

contaminant plume
An elongated body of groundwater containing contaminants that originate and migrate from a source within subsurface rocks or deposits.

Process used to determine sustainable yield:

1. A baseline year was established (1990).
2. Baseline scenarios were developed to project changes in land use and water demands within the Water Forum 2030 planning horizon.
3. It was assumed that new urban growth outside surface water delivery areas would use only groundwater.
4. Impacts of increased groundwater extraction were investigated (impacts included groundwater quality degradation, number of wells affected, pumping costs, land subsidence, and contaminant plume movement).
5. To consider increased natural groundwater recharge from hydraulically connected streams and rivers, reduced flows in the American River were evaluated.

Water Forum negotiations:

1. Identified levels of acceptable impacts.
2. Considered availability of surface water and groundwater.
3. Considered economics (surface water costs, pumping costs, well replacement costs, and treatment costs).
4. Identified recharge from streams/rivers for the baseline years.

Sustainable Yield (cont'd)

Water Forum 2030 solution:

1. Increase water conservation from 8 percent to 25.6 percent (see page 2-23) with full implementation of Urban Best Management Practices (BMP).
2. Maximize surface water when available.
3. Use groundwater in dry years but not in excess of the sustainable yield over the long term (i.e., promote conjunctive use).

Water Forum sustainable yield recommendation:

1. Baseline condition for 2005 --- 273,000 acre-feet/year.

Conditions that could require review of the sustainable yield recommendation by a locally determined and controlled agency or authority overseeing groundwater use in the Central Basin:

1. Cumulative impacts of groundwater contamination and remediation.
2. Impacts of groundwater pumping on the Cosumnes River.

BMP
best management practices
Policies, rules, or regulations that result in greater efficiency or benefits.

contamination (water)
The addition to water of any substance or property preventing the use or reducing the usability of the water.

remediation (groundwater)
"Cleanup" of contaminated groundwater by a variety of methods.

Zone 40

What is "Zone 40"?

Zone 40
A zone in Sacramento County created by the SCWA to develop a conjunctive use program for protecting the long-term viability of Central Basin groundwater.

SCWA
Sacramento County Water Agency
County agency responsible for water supply planning.

Zone 40 was created in May 1985 by Sacramento County Water Agency Resolution No. 663, which defined the boundaries of the zone; these boundaries were expanded in 1999 to reflect the area shown in **Figure 15**. The Sacramento County Water Agency (SCWA) identified Zone 40's purpose as the "acquisition, construction, maintenance, and operation of facilities for the production, conservation, transmittal, distribution, and sale of ground or surface water or both for the present and future beneficial use of the lands or inhabitants within the zone." To achieve this purpose, Zone 40 is implementing a conjunctive use program that will assist in protecting the long-term viability of Central Basin groundwater. Implementing conjunctive use is also a requirement of the

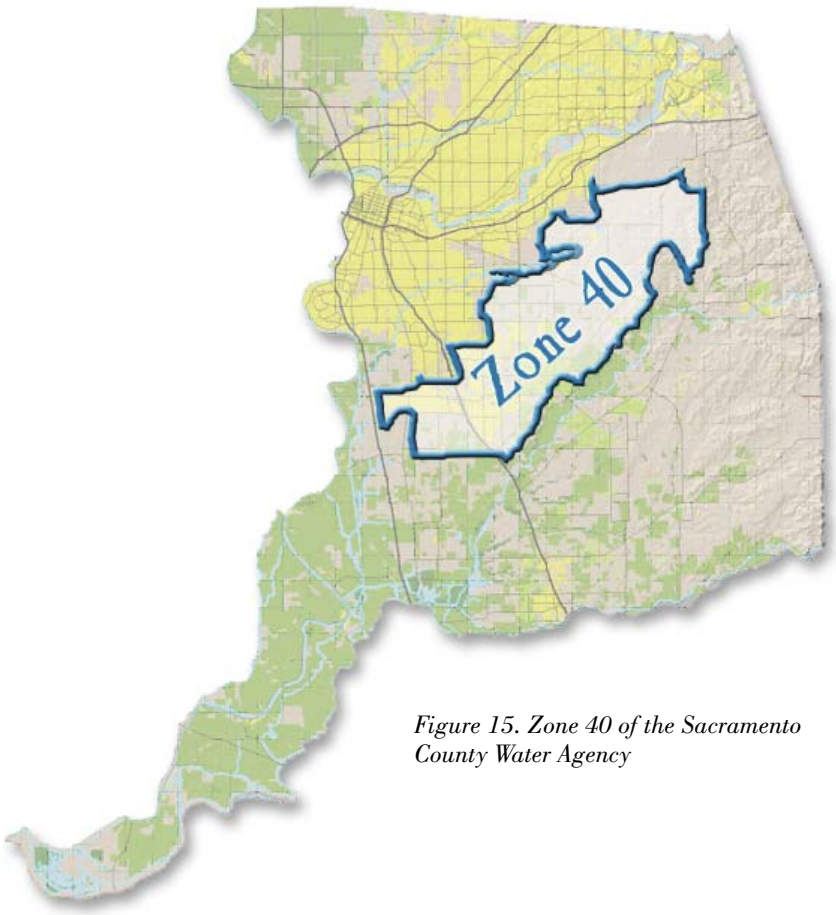


Figure 15. Zone 40 of the Sacramento County Water Agency

Zone 40 (cont'd)

Water Forum Agreement. Therefore, SCWA plans to use 78,000 acre-feet of long-term surface water supplies from the following sources:

- SCWA has secured a long-term contract for 15,000 acre-feet of Central Valley Project (CVP) water under the authorization of Public Law 101-514 (Fazio water).
- Up to 30,000 acre-feet of CVP contract water will be transferred from the Sacramento Metropolitan Utility District (SMUD) to SCWA, in accordance with the Water Forum Agreement. A Draft Environmental Impact Report (DEIR) is currently out for public comment.
- An additional intermittent surface water supply of 33,000 acre-feet has been planned by SCWA; this supply will be used in "wet years" when Sacramento-San Joaquin Delta needs have been met. Also called "excess water," this supply is appropriated water in excess of the amount required to maintain the Sacramento-San Joaquin Delta in balance. SCWA has a pending application at the State Water Resources Control Board for this allotment.

Summary of Surface Water Supplies

Source	Amount (acre-feet/year)
Fazio	15,000
SMUD	30,000
Intermittent	33,000
Total	78,000

Also, SCWA will purchase 9,300 acre-feet of water from the City of Sacramento for use in the portion of Zone 40 that lies within the city's American River place of use (POU).

Conveyance of long-term water supplies is occurring, in part, through a "wheeling agreement" between SCWA and the City of Sacramento. The City diverts and treats a portion of SCWA's CVP water at the City's Sacramento River Water Treatment Plant and delivers it to SCWA's Franklin Intertie on Franklin Boulevard near the Sacramento Regional Wastewater Treatment Plant. The maximum capacity of the wheeling agreement is 11 million gallons per day (mgd). In 2002, the City wheeled approximately 4,500 acre-feet to SCWA for use in the Laguna area (see **Figure 12**). Under this agreement, the amount of surface water delivered to Zone 40 will increase approximately 1,000 acre-feet each year until the full wheeling agreement amount of 12,300 acre-feet (11 mgd) is reached or SCWA constructs its own diversion and treatment facility.

CVP
Central Valley Project
A federal construction project begun during the Depression. The CVP stores and transports surplus water from the Sacramento and San Joaquin rivers for use primarily in the Central Valley.

Fazio water
Permanent supply of 15,000 acre-feet of water from the CVP for Sacramento; so-named for Senator Vic Fazio, who supported legislation to obtain this supply.

DEIR
Draft Environmental Impact Report
Document required by the state that assesses possible impacts of a project on the environment.

wet years
Years with greater than average precipitation that result in more surface water in streams and rivers, and more deep percolation of water into groundwater basins.

POU
Place of use for City of Sacramento's American River water entitlement.

wheeling agreement
An agreement that allows a purveyor to divert, treat, and deliver water belonging to another purveyor.

mgd
Million gallons per day.

Contamination

Is groundwater in the Central Basin contaminated?

TCE
trichloroethene
: Nonflammable organic compound used as a solvent and for dry cleaning and removing grease from metal.

PCE
perchloroethene
: Colorless, odorless, nonflammable organic compound often used as a solvent in dry cleaning and for removing grease from metals.

BTEX
benzene, toluene, ethylbenzene, and xylene
: Constituents of gasoline.

perchlorate
: Primary ingredient in solid propellant for rockets and missiles, and is a common contaminant found in groundwater supplies in and around aerospace and military facilities.

NDMA
N-nitrosodimethylamine
: Chemical used in production of 1,1-dimethylhydrazine for liquid rocket fuel and a variety of other industrial uses.

volatile organic compounds
: Any carbon-based compound that volatilizes at atmospheric conditions.

Groundwater contamination is a major concern for the Central Basin, within which three United States Environmental Protection Agency Superfund sites are located: Aerojet, the former Mather Air Force Base, and the Sacramento Army Depot (**Figure 16**). Another Superfund site, the former McClellan Air Force Base, is nearby in the north area subbasin. Other contaminated sites within the Central Basin include the Kiefer, Elk Grove, and Gerber landfills, an abandoned Pacific Gas and Electric (PG&E) facility on the Sacramento River, and the Southern Pacific and Union Pacific railroad yards (**Figure 16**). A number of groundwater wells near some of these sites have been shut down due to contamination. Contaminants have included solvents (TCE, PCE, and BTEX), fuels, perchlorate, N-nitrosodimethylamine (NDMA), and volatile organic compounds. A number of government regulatory agencies are participating in ongoing remediation (cleanup) efforts at these sites. However, migration of contaminants as a result of increased groundwater use within the Central Basin continues to be of concern.

To assist CSCGF, and any groundwater management entity that evolves from recommendations of CSCGF, the Water Forum Successor Effort has initiated an engineering study that will include a cumulative analysis of groundwater contamination in central Sacramento County. This study will identify potential effects of contaminant migration and develop groundwater management strategies based on study findings. Initial funding has been secured and additional funding sources for this study are being investigated.

Figure 16. Contaminated Sites in Sacramento County

Conservation

Can conservation benefit Central Basin groundwater?

Conservation can help meet water supply needs in the Central Basin and minimize the need for increased groundwater and surface water use. (Water conservation is one of the seven elements of the agreement). Each water purveyor who signed the Water Forum Agreement has agreed to implement water conservation BMPs, including residential meter retrofits and conservation pricing, toilet replacement programs, and citizen involvement programs. Signatories agreed to fully implement their water conservation programs by 2004. The Water Forum expects to achieve a gross water savings of 25.6 percent by 2030 (a baseline of 8.5 percent conservation was determined using 1990 water use data), assuming full implementation of all BMPs.

Agricultural water conservation is projected to increase during the 30-year planning period of the Water Forum Agreement; however, no agricultural water conservation program is currently in place. The Water Forum will negotiate the specifics of an agricultural water conservation program at a later time. (For a complete description of conservation plans, see the Water Forum Agreement, Appendix J.)

Recycling

Can water recycling benefit Central Basin groundwater?

SRCSD
Sacramento Regional County Sanitation District
: Agency responsible for large conveyance and treatment of wastewater within the urbanized area of Sacramento County.

Title 22
: Section of the California Code of Regulations that regulates water quality for a variety of uses.

Regional Water Quality Control Board
: State of California agency that is set up to preserve, enhance, and restore the quality of California's water resources.

The Sacramento County Regional Sanitation District's (SRCSD) water recycling program produces highly treated wastewater suitable for beneficial uses such as landscape irrigation, cooling towers, industrial reuse, etc. Such water may also be used for agricultural applications such as irrigating edible root crops. In addition, this recycled water may be used for recharging groundwater aquifers via surface spreading basins.

SRCSD has completed construction of a treatment plant that has a capacity of 5 million gallons per day (mgd) and is expandable to 10 mgd. The SRCSD program began delivering recycled water in summer 2003 for landscape irrigation in the Laguna, Laguna West, and Laguna Stonelake areas. Previously, irrigation for these areas came from treated groundwater and surface water supplies.

Treated wastewater must meet strict standards set by Title 22 of the California Code of Regulations. Furthermore, use of treated wastewater is regulated by at least five state and federal government agencies, including the California Department of Health Services and the Regional Water Quality Control Board.

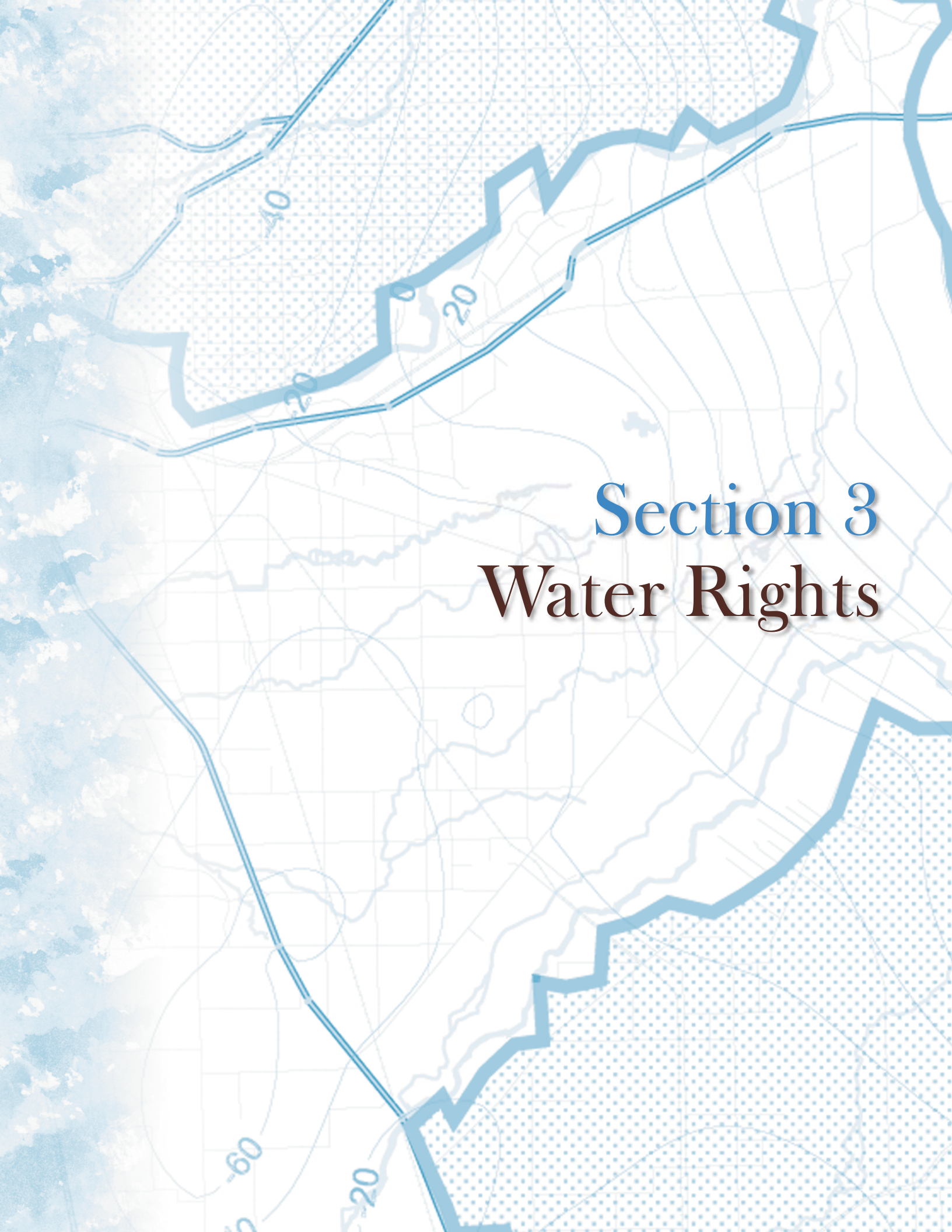
Recycled water is currently used in other Sacramento Valley communities, including the City of Roseville, El Dorado Hills, and the City of Stockton.

Future Studies and Projects

What future studies and projects are scheduled for the Central Basin?

The following groundwater studies and projects are pending in the Central Basin:

- A Zone 40 Master Plan DEIR is scheduled to be completed in late September 2003. The DEIR will address groundwater issues related to the Cosumnes River, existing contamination plumes, proposed remediation, and reuse.
- The Freeport Regional Water Project DEIR was completed in August 2003 and clearly defines the project and the yield of surface water supplies to Zone 40.
- As discussed previously, the Water Forum Successor Effort has initiated a summary and graphical depiction of groundwater contamination in the Central Basin that will help CSCGF members understand the rate of movement, location, and level of risk associated with contaminants for each site.
- SRCSD's recycling program will be expanded in 2003 and will supply recycled water for landscaping in East Franklin and Laguna Ridge areas.
- In cooperation with DWR, SCWA will conduct groundwater studies to investigate alternatives for using remediated groundwater throughout the Central Basin.



Section 3
Water Rights

Water Rights

Section 3

With a basic understanding of groundwater concepts and uses, it is important to understand who "owns" the groundwater as a next step in discussing groundwater management in the Central Basin. Types of water rights that have evolved over time in California, and that may apply to the Central Basin, include the following:

Appropriative right. This right is gained through extracting and using water for reasonable and beneficial uses. Because this right does not depend on ownership of the overlying land, the rights of an appropriator depend on actual physical control of the water (and since 1914, a permit for its beneficial use).

Correlative right. A correlative right is one that has a mutual or reciprocal relationship to the rights of others, in the sense that the existence of one necessarily implies the existence of the other. For example, the rights of landowners in a given basin to extract groundwater are correlative with all other landowners in that basin.

Overlying right. An overlying right is the right of landowners to take water from the aquifer beneath their property for reasonable and beneficial use on the land overlying the aquifer. Overlying rights exist by virtue of land ownership.

Prescriptive right. A prescriptive right comes into existence only if a groundwater basin has no "surplus" water available. Such a right is gained by appropriating nonsurplus water for a statutorily prescribed period.

Riparian right. Those who own property adjacent to a body of water possess the right to use the water for reasonable and beneficial purposes. All riparian rights are correlative.

Subordinate right. A subordinate right is one that is inferior to or secondary to a higher right.

"Owners" of groundwater in the Central Basin are among the many stakeholders represented in CSCGF. These stakeholders are considering management options for protecting the health, viability, and availability of groundwater in the Central Basin.

reasonable and beneficial use
Refers to Article X, Section 2, of the California Constitution. Section 2 requires that all water use be reasonable and beneficial. Beneficial uses include irrigation, domestic, M&I, hydroelectric power, recreation, and protection and enhancement of fish and wildlife. Reasonable use can be defined by what it is not: waste or unreasonable use. Reasonableness is determined based on circumstances and can vary according to the California Supreme Court.

surplus water
Water in excess of environmental use and state and federal water projects.

Section 4
Governance Options

Governance Options

Section 4

This section describes various groundwater management options, and gives details of three that may be more feasible for the Central Basin.

Methods of Groundwater Management

In California, no mandatory groundwater management scheme is imposed by state statute; the state is not authorized by the California State Water Code to manage groundwater. As a result, five methods of groundwater management have evolved over time, including the following:

adjudicated basin
: Groundwater basin for which it has been determined by the court system who has rights to water and how much of the water.

- **AB 3030 plan.** The Groundwater Management Act, commonly referred to as AB 3030, was signed into law on September 26, 1992, and became effective on January 1, 1993. AB 3030 allows certain local public agencies to form a groundwater management plan, called an AB 3030 plan, and have management authority over groundwater resources. Implementation of and participation in an AB 3030 plan is voluntary, not mandatory.
- **Adjudicated basin.** In some California groundwater basins, landowners or other stakeholders turn to the courts to settle disputes over how much groundwater can rightfully be extracted by each landowner. (This process can be lengthy and costly.) Sixteen basins in California are adjudicated basins. For these basins, the courts determine who can pump groundwater, how much groundwater each extractor may use, and who will manage the basin according to the court's decree.
- **City and county ordinances.** In 1995, by declining to review a lower court decision, the California Supreme Court acknowledged that cities and counties have the power to regulate groundwater under their existing police powers.
- **Local agencies.** Twenty-three types of districts or local agencies are identified in the California Water Code as having authority to manage surface water. Some of these entities also have the authority to develop some forms of groundwater management. Certain districts or agencies have done so; others have not. (SCWA is a local agency.)
- **Special legislation districts.** In California, groundwater management districts or agencies with special powers to regulate groundwater can be formed only after special legislation is enacted by the state legislature (there is no generic groundwater management district act in the State Water Code). Special legislation by the State of California has created 12 groundwater

Joint Powers Agreement
Two or more public agencies may, by agreement, jointly exercise any power held in common.

management agencies or districts. For most of the districts, the legislation was passed only after several years of effort by landowners and other stakeholders in the affected areas. Such legislation allows the districts to enact ordinances to limit or regulate groundwater extraction.

Selecting a Groundwater Management Option

To determine which groundwater management option might be the most practicable for the groundwater basin in the Central Basin, these criteria can be applied:

- What is simplest?
- What is most cost-effective?
- What will enhance the sustainability of the groundwater resource?
- What will ensure local control of the basin?
- What will protect the rights of all users?

Considering these standards, three of the options outlined above seem most relevant:

1. AB 3030 plan. The California Water Code (§10750 et seq.) provides statutory authority for public water agencies to develop groundwater management programs in unregulated groundwater basins. Details of the management program are determined at the local level.

Such a plan is entirely voluntary and not mandatory. A protest by a majority of landowners in the district can halt implementation. In addition, pursuant to the Water Code, an election is required before an agency can fix or collect any fees to support the groundwater management program.

The Water Code also requires coordination among local agencies, encourages memoranda of understanding and Joint Powers Agreements for cooperative programs, and prohibits new programs where groundwater is already subject to management.

2. City and county ordinances. Because the cities of Elk Grove, Rancho Cordova, and Sacramento and Sacramento County already have authority to manage groundwater under their existing regulatory/police powers, a Joint Powers Agreement could be created to establish a Joint Powers Authority (JPA) for managing groundwater in the Central Basin. The responsibilities of the JPA would specifically include determining and maintaining the sustainable yield of the basin, managing use of groundwater, helping to implement conjunctive use programs, and coordinating efforts among participants to devise and execute strategies to safeguard groundwater quality.

JPA
Joint Powers Authority
Organization formed to carry out a Joint Powers Agreement.

Proposition 218
State of California legislation that requires voter approval prior to assessment of any new fee or tax.

To meet legal requirements, all members serving on the JPA would have to be appointed by the signatories of the JPA (i.e., the cities and Sacramento County). Who would be represented as a member of the JPA (i.e., which interests) and who would appoint those representatives would be negotiated by CSCGF and included in the provisions of the JPA. Specifics of how the JPA would make decisions (i.e., voting procedures) could also be negotiated by the CSCGF and included in the JPA.

The JPA would be responsible for determining the allocation of and rate for regulatory fees or charges to cover costs for operating the JPA.

3. Local agencies. The SCWA is a local agency. Under the authority of the Sacramento County Water Agency Act (6730 - §32 – 55), the SCWA Board of Directors may establish groundwater management zones within any area under the jurisdiction of the SCWA that has been identified in a map filed by the clerk of the board. Changes to the map may be made through the same procedures that were required to form the zone.

A groundwater management zone is created through proper public notice and hearings that define groundwater problem(s) and potential solutions(s). If owners of 50 percent or more of the land area or 50 percent or more of the registered voters within the proposed zone protest, the proceeding is to be terminated for a minimum of 6 months.

The SCWA Board of Directors, after creating a Sacramento County Groundwater Management Zone, could levy and collect groundwater charges for producing groundwater within the zone. These charges would most likely be subject to the requirements of Proposition 218, which requires voter approval prior to assessment of any new fee or tax.

The Sacramento County Water Agency Act further allows Groundwater Management Zone Councils to be created to advise the Board of Directors. The number of members for each council and terms of office for council members would be determined by resolution of the board. Members must be appointed by the board from among eligible voters or landowners within the groundwater management zone.

Next Steps

Stakeholders who represent all segments of the community in the Central Basin were identified and invited to join CSCGF. During CSCGF meetings, stakeholders participated in an education process to gain an understanding of current groundwater conditions in the Central Basin. Members of CSCGF are now poised to participate in an interest-based negotiation process to choose how groundwater in the Central Basin might be managed (i.e., choice of governance method and subsequent negotiated program standards and regulations). The future of groundwater in the Central Basin depends on informed decisions made today.

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FAQs

FAQs

List of Frequently Asked Questions

Frequently asked questions are sorted below into seven categories and grouped according to topic.

Facts and Figures

Many questions were asked about the Central Basin, groundwater agencies, groundwater, groundwater concepts, use, and levels, and land use, topics that were discussed in presentations during Central Sacramento County Groundwater Forum (CSCGF) meetings. Section 2 discusses these topics and reviews facts and figures presented during CSCGF meetings.

General

Where is the Central geographically located?

Describe the Central Basin and its relationship to the North Basin.

Give overall statistics for the Central Basin – estimate yields, affect of contamination, projected demands.

Zone 40

Describe Zone 40 – it may not be well-understood.

How does Zone 40 compare with the Central Basin in size?

What or who is the groundwater forum?

Sustainable yield

What is sustainable yield?

What is sustainable yield and how was it determined?

What is safe yield?

Define and explain groundwater "yield," sustainable, safe, etc.

What level of confidence do we have in the sustainable yield (273,000 acre-feet/yr)? This will impact many groundwater basin decisions.

Water supply and demands

Explain water demands and needs and list the average and typical needs for various users.

What is the population in the area and the annual water consumption?

What is the General Plan Policy re conversion of irrigated ag to urban use, and how much ag land has been converted to urban uses?

How many acre-feet of Fazio water were used in 2002 and how were they routed?

How many wells are there within the basin?

FAQs (cont'd)

Conjunctive use and recharge

Define and explain conjunctive use. Include "recharge" and explain potential for success.

What is the best way to implement groundwater recharge?

When is a groundwater basin in overdraft?

Groundwater levels

How much has the groundwater level gone down, on average, in the basin?

What was the depth of the cone of depression in the Central Basin in 2002/2003?

What was the proposed depth of groundwater in Elk Grove in 2030?

How would groundwater be managed?

Many questions were also asked about how groundwater would be managed. Groundwater management options are discussed in Section 4. However, stakeholders will determine, in an interest-based negotiation process, how Central Basin groundwater will be managed within the framework of the management option they choose.

Managing the groundwater in the Central Basin and elsewhere

Who will manage the groundwater? Would they be trustworthy?

Is groundwater management going to be administered by the residents of the area (which would be preferred)?

What role (voting structure) will ag play on the governing board?

Provide a summary of basin governance for other basins in California or western states.

Participation and representation

Is it mandatory for all groups to comply? Could ag-res opt out?

Does groundwater planning protect all the interests of the participants?

Costs and cost-sharing

Who will pay for managing groundwater?

How will it be managed and funded?

How will cost-sharing by implemented to insure equity?

Will agriculture be required to cost-share for groundwater management – need an actual benefit.

Provide a summary of user charges (taxes, etc.), either M&I or well charges. What are other basins doing with respect to charges to pay for basin management?

Should the CSCGF and SGA have some shared language for consultant work, thereby providing ability to blend documents and studies in the future?

Government agencies

Why should local government agencies be concerned with groundwater management?

Will local government agencies be required to prepare a management plan for wells?

FAQs (cont'd)

Monitoring and quotas

How would groundwater levels be monitored?

What use limitations, if any, will be applied to groundwater usage?

Groundwater banking

How will credits be given to groundwater banking, if at all?

How will the plan handle groundwater banking?

What efforts are going to be included in this plan to benefit groundwater recharge?

Funding

What is required in a groundwater management plan to be in compliance with existing laws and eligible for funding?

Flexibility

What if our assumptions vary in reality?

Will groundwater management encourage development?

Concern was expressed that groundwater management would favor development and it was suggested that development could be restricted. However, land use decisions ultimately control growth. Such decisions are the prerogative of Sacramento County and the cities located within the Central Basin. Groundwater management is essential to protect the long-term viability of the Central Basin for any growth scenarios adopted by the cities and Sacramento County. Again, stakeholders are responsible for setting the parameters of groundwater management for the Central Basin. Since CSCGF includes members representing all segments of the community that have an interest in groundwater, a broad diversity of interests are represented in the negotiation process. See section 4 for a description of various groundwater management options.

Development

Will groundwater management make it easier for developers to increase/accelerate development outside the urban services boundary?

Does groundwater planning promote growth?

Will the interests of developers take priority?

Could the problem of water supply be solved by the County placing a moratorium on growth [as opposed to groundwater management]?

Does Elk Grove have enough groundwater to serve its housing growth?

Freeport Project

Why is development allowed to use groundwater in anticipation of the Freeport Pumping Plant?

What happens if Freeport water does not materialize?

Discuss Freeport Project – and relationship with groundwater.

FAQs (cont'd)

How will groundwater management affect my well?

Questions were asked about affects of groundwater management on groundwater levels and wells, whether groundwater users would incur costs, and if wells would be metered. Section 2 discusses recharge and sustainable yield; decisions about how costs might be structured will made by the stakeholders who negotiate the groundwater management plan (Section 4).

Groundwater levels.

Will groundwater pumping be cut back if the water able reaches a predetermined depth?

What effect will proposed pumping yield have on groundwater levels?

Affects on wells

How does this affect my well?

What protection is afforded ag/res uses that the groundwater won't be reduced to a level causing outages and new well drilling?

How can the county/city or Elk Grove assure current groundwater-dependent users that no further impacts occur by the approval of development in the basin?

What will happen/who will be responsible if my well goes dry?

For all existing groundwater users, particularly those with typical residential wells, what assurances are there that they will be saved from damage?

Metering

Will the groundwater management plan or governance model result in my well being metered?

Cost to groundwater users

Is this going to cost me anything?

Groundwater pumping assurances, including costs paid for continued well (s) use – who pays?

What compensation will be afforded ag/res users who have to drill wells deeper due to increased use of groundwater by developments?

How will private pumpers be affected?

What are the estimated or potential costs to groundwater pumpers (ag or ag-res)?

Will water meters or service charges be levied against current private pumpers?

The proposed plan may have an effect on the cost of water pumped. Will the plan provide investor-owned language to justify the cost increase to the CPUC?

FAQs (cont'd)

How will groundwater management address contamination?

Groundwater contamination in the Central Basin in general and specific contaminated sites were subjects of concern and many questions. Section 2 briefly discusses locations and types of contamination and a groundwater contamination investigation that will be performed to provide current information on contaminants in the Central Basin.

Contaminants and contaminant sources

Discuss all contaminant sources.

List known and potential contaminants and their potential effects.

Regarding historical trends in the health of the aquifers – what were biggest impacts (e.g., perchlorate contamination, gravel mining)?

Water quality

How will water quality be affected?

What are the water quality issues [for the Central Basin]?

How can we assure protection of our water supplies from contamination?

Who guarantees that water quality will be maintained in private wells?

What are the projected groundwater losses over the next 20 years due to contamination?

Contamination sites

What is the status of the Kiefer Landfill contamination plume?

What happens if "Vineyard Spring" wells become contaminated from the Gerber Landfill?

Where will housing at Grintline and Jackson get water when the Kiefer Landfill plume reaches their wells?

How can conservation, recycling, water purchases/sale, and water storage be used to help meet water supply needs?

See Section 2 of the Groundwater Digest.

Conservation

Include water conservation methods and its potential benefits.

Recycling

Explain remediation – methods, time requirements.

Why doesn't Aerojet put the "reclaimed water" into the Consumnes instead of the American River?

Will the plan specifically discuss reuse water from remediation efforts?

What is CSCGF's position on remediated water pumped into surface water channels?

Is it expected that this water can be treated and kept in the basin?

When will contaminated water be usable? The sooner the contaminated water is usable, the sooner it will cease to be a problem.

FAQs (cont'd)

Water purchases/sales

Why doesn't the county buy the water that farmers are selling out of the area?

What efforts are taking place to acquire additional surface water in place of adding extensive demand upon groundwater resources?

Water storage

Is there a storage problem?

How will groundwater management affect the Cosumnes River and other natural resources?

Section 1 discusses support for Cosumnes River restoration efforts as a potential advantage of groundwater management; Section 2 explains basin recharge, contains a figure showing the Cosumnes River and other rivers in the Central Basin, and discusses recharge in terms of sustainable yiels.

Effects of groundwater management

Describe relationship [of groundwater management] with Cosumnes River impacts, potential benefit.

Hydraulic connection

How can we continue to draw down upstream water in the Cosumnes River when it runs dry every year?

What protections will be afforded to maintain Cosumnes River flow?

Glossary

Glossary

Central Basin Groundwater Glossary

acre-foot
Amount of water it takes to cover an acre of land to a depth of 1 foot; about 326,000 gallons. An acre-foot can supply the annual needs of between one and two average California households.

adjudicated groundwater basin
Groundwater basin for which it has been determined by the courts who has rights to water and how much of the water.

ag (land use)
agricultural
Properties in the Central Basin of more than 5 acres, typically used for row crops, vineyards, grazing, etc.

ag-res (land use)
agricultural-residential
Small farms or residences of generally 5 acres or less.

alluvial deposit; alluvium
Clay silt, sand, gravel, or cobble deposited by rivers and streams over long periods of time.

aquifer
Geologic formation that is water-bearing and permeable and yields economically significant amounts of water to wells or springs.

aquifer system
Regional set of interbedded geologic formations within a groundwater basin.

artificial recharge
When surface water is added to a groundwater basin by human activity.

BMP
best management practice
Policy, rule, or regulation that results in greater efficiency or benefits.

BTEX
benzene, toluene, ethylbenzene, and xylene
Constituents of gasoline.

Central Basin
Common name for the central area of the groundwater basin in Sacramento County.

cone of depression
A depression of the water table surface in the shape of an inverted cone. Localized cones of depression develop around a well or wells that are being pumped. Regional cones of depression occur from long-term pumping in a groundwater basin.

confined aquifer
Has a confining layer at the top, causing the groundwater to be under pressure.

conjunctive operation (water)
The operation of a groundwater basin in combination with surface water. Groundwater is stored in the basin for later use by intentionally recharging the basin during years of above-average surface water supply.

conjunctive use (water)
Coordinated management of surface water and groundwater supplies to increase the yield of both. Conjunctive use is intended to increase total supplies and enhance water supply reliability.

conservation reserve (land use)
Land along waterways and in other areas that is set aside and protected.

consolidated rock
Mineral particles of different sizes and shapes that have been welded together into a solid mass by heat and pressure or chemical reactions. Examples of rocks important for groundwater include limestone, dolomite, shale, siltstone, sandstone, and conglomerate.

contaminant plume
An elongated body of groundwater containing contaminants that originate and migrate from a source within subsurface soils, rocks, or unconsolidated deposits.

contamination (water)
The addition to water of any substance or property preventing the use or reducing the usability of the water.

CSCGF
Central Sacramento County Groundwater Forum
Group of stakeholders formed under the aegis of the Water Forum Successor Effort to develop recommendations for Central Basin groundwater.

CVP
Central Valley Project
Federal construction project begun during the Depression. The CVP stores and transports surplus water from the Sacramento and San Joaquin rivers for use primarily in the Central Valley.

Central Basin Groundwater Glossary (cont'd)

deep percolation
The percolation of surface water through the ground and beyond the lower limit of the root zone of plants into a groundwater basin or aquifer.

DEIR
Draft Environmental Impact Report
Document required by the state that assesses possible impacts of a project on the environment.

dual-purpose well
Groundwater well that is used for both extraction and injection.

DWR
California Department of Water Resources
State agency responsible for managing the water resources of California in cooperation with other agencies to benefit California residents and to protect, restore, and enhance the natural and human environments.

Fazio water
Permanent supply of 15,000 acre-feet of water from the CVP for Sacramento; so-named for Senator Vic Fazio, who supported legislation to obtain this supply.

General Plan
Document used by Sacramento County and incorporated cities to plan for providing infrastructure for future development within identified boundaries.

geologic formation
Set of consolidated rocks or unconsolidated deposits that forms a unit and may be dominated by a certain type of deposit or rock, or may have some other common feature.

groundwater
Water that is stored in the pore spaces of consolidated rocks or unconsolidated deposits found in the saturated zone of an aquifer.

groundwater basin
Flow system that has a surface and a subsurface area with defined boundaries, and materials (rocks or unconsolidated deposits) that can store water.

hydraulic connection
When surface water and groundwater are connected (allows groundwater to be recharged). Can also refer to a connection between two aquifer zones.

hydrogeology
Science that deals with subsurface waters and related geologic aspects of surface waters.

hydrology
Science that deals with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere.

in-lieu recharge
Indirect method of recharge – groundwater users use excess surface water in lieu of groundwater.

interbedded
Beds lying between or alternating with others of a different type.

Joint Powers Agreement
Two or more public agencies may, by agreement, jointly exercise any power held in common.

JPA
Joint Powers Authority
Organization formed to carry out a Joint Powers Agreement.

land subsidence
The lowering of the natural land surface in response to a lower groundwater level. Caused by removal of groundwater and subsequent consolidation of certain soil types.

mgd
million gallons per day

M&I (land use)
municipal and industrial
Urban or industrial development.

mountain front recharge
When precipitation and runoff enter geologic formations that are exposed along the front of mountains and this water travels into aquifers via the formations.

native lands (land use)
Undeveloped land (i.e., not ag, ag-res, M&I, etc.).

NDMA
N-nitrosodimethylamine
Chemical used in the production of 1,1-dimethylhydrazine for liquid rocket fuel, and for a variety of other industrial uses.

overdraft
Over a period of years, withdrawing from an aquifer (on purpose or inadvertently) more water than the amount of water recharging the basin.

PCE
perchlorothene
Colorless, odorless, nonflammable organic compound often used as a solvent and for dry cleaning and removing grease from metals.

Central Basin Groundwater Glossary (cont'd)

perchlorate
Primary ingredient in solid propellant for rockets and missiles, and is a common contaminant found in groundwater supplies in and around aerospace and military facilities.

percolation
Movement of water through small openings (pore space) within a porous material.

permeability (groundwater)
Ability of a rock or unconsolidated deposit to transmit water through spaces that connect between grains. The size and shape of the spaces controls how well water transmits, or "flows." Usually expressed in millidarcies.

porosity
Volume of open pore space between particles of clay, silt, sand, gravel, or cobble in a geologic formation, usually expressed as a percentage.

POU (American River)
place of use
Location for use of City of Sacramento's American River water entitlement.

Proposition 218
State of California legislation that requires voter approval prior to assessment of any new fee or tax.

reasonable and beneficial use
Refers to Article X, Section 2, of the California Constitution, which requires that all water use be reasonable and beneficial. Beneficial uses include irrigation, domestic, M&I, hydroelectric power, recreation, and protection and enhancement of fish and wildlife. Reasonable use can be defined by what it is not: waste or unreasonable use. Reasonableness is determined based on circumstances and can vary according to the California Supreme Court.

recharge (groundwater)
Water reaching the saturated zone of an aquifer where it is available for extraction.

Regional Water Quality Control Board
State of California agency that is set up to preserve, enhance, and restore the quality of California's water resources.

remediation (groundwater)
"Cleanup" of contaminated groundwater by a variety of methods.

safe yield
Maximum quantity of water that can be withdrawn from a groundwater basin over a long period of time without developing a permanent condition of overdraft. Sometimes referred to as sustainable yield.

saturated zone in an aquifer
Zone with only water in the interconnected spaces.

SCWA
Sacramento County Water Agency
County agency responsible for water supply planning.

semiconfined aquifer
Confined by upper layers having permeability that varies from low to moderate. Thus, groundwater moves through these confining layers, but moves slowly.

semipermeable (groundwater)
In a formation, having small preferential flow paths through mostly impermeable material.

SGA
Sacramento Groundwater Authority
The groundwater management element of the Water Forum Agreement led to creation of the Sacramento North Area Groundwater Management Authority, which was later renamed the SGA. This agency is responsible for managing groundwater in the north area subbasin of Sacramento County.

SRCSD
Sacramento Regional County Sanitation District
Agency responsible for large conveyance and treatment of wastewater within the urbanized area of Sacramento County.

stakeholders
Persons, agencies, groups, or other parties who have a "stake" in a common issue, project, etc.

subsurface water
Water under the surface of the earth.

surface spreading basin
Basin above an aquifer that is filled with water in areas of good percolation.

surface water
All waters on the surface of the earth, including fresh water (streams, rivers, lakes) saltwater, ice, and snow.

Central Basin Groundwater Glossary (cont'd)

surface water recharge
Recharge from rainfall that percolates down to aquifers, and from rivers and streams that may not be connected to the water table. Surface water is always recharging groundwater. One result of this continuous recharge is that groundwater can be contaminated from land use practices at the surface.

surplus water
Water in excess of environmental use and state and federal water projects.

sustainable yield
The amount of groundwater that can be safely pumped from a basin on a long-term average annual basis without damaging the aquifer.

TCE
tricholorethene

Nonflammable organic compound used as a solvent and for dry cleaning and removing grease from metal.

Title 22
Section of the California Code of Regulations that regulates water quality for a variety of uses.

transition zone
Zone between the unsaturated and saturated zones of an aquifer.

unconfined aquifer
Aquifer without a confining layer at the top; therefore, a corresponding lack of pressure allows the water level to rise or fall.

unconsolidated deposit
Material consisting of particles of rocks or minerals ranging in size from clay to boulders. Examples of unconsolidated deposits important for groundwater are clay, silt, sand, gravel, and cobble (in order of increasing grain size).

unsaturated zone in an aquifer
Zone that lies just below the land surface and contains both air and water.

volatile organic compounds
Any carbon-based compound that volatilizes at atmospheric conditions.

Water Forum
Diverse group of business and agricultural leaders, citizen groups, environmentalists, water managers, and local governments in the Sacramento region formed to develop and implement a plan to ensure the region's water supply needs to 2030 while preserving the ecosystem of the Lower American River.

Water Forum Agreement
An agreement negotiated over 6 years by a diverse group of stakeholders in the Sacramento region. The agreement has two co-equal objectives: 1) to provide a reliable and safe water supply for the region's economic health and planned development through 2030, and 2) to preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.

Water Forum Successor Effort
Group formed after the Water Forum Agreement was signed to carry forward the agreement and address changed conditions. Members of the group represent stakeholders who signed the Water Forum Agreement.

watershed
Region that is drained by, or contributes to, streams, lakes, rivers, or other bodies of water.

water table
Level in the saturated zone of an aquifer where the pressure from the air and the pressure from the water are equal. In an unconfined aquifer, the water table is the top of the saturated zone and the bottom of the unsaturated zone.

wet years
Years with greater than average precipitation that results in more surface water in streams and rivers and more deep percolation of water into groundwater basins.

wheeling agreement
An agreement that allows a purveyor to divert, treat, and deliver water belonging to another purveyor.

Zone 40
A zone in Sacramento County created by the SCWA to develop a conjunctive use program for protecting the long-term viability of Central Basin groundwater.

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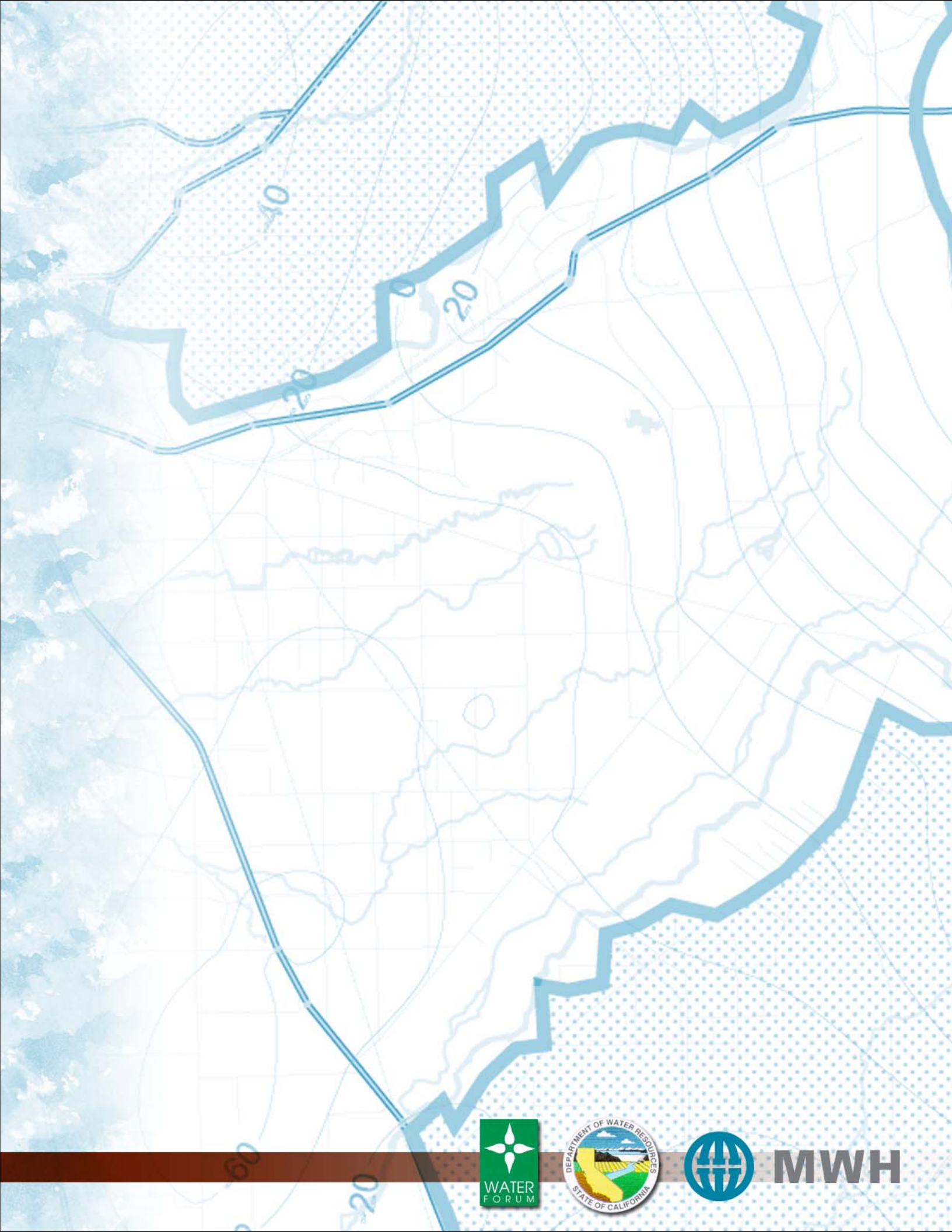
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